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Computer Fair

£1 admission voucher inside

YOUR COMPUTER

JUNE 1983 BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE Vol. 3 No. 6

Brave the corridor of fire in our Scram-20 Vic game

Reviews: BBC speech chips

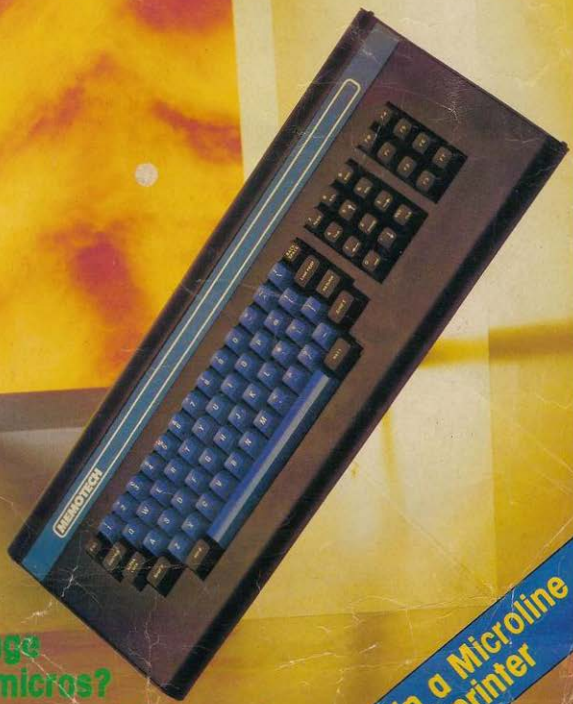
Vic-20 software

Spectrum Minefield

Starting Oric graphics

Dragon flight simulator

ZX-81 quick loader and 1K wonders



Can Memotech change the shape of home micros? We preview the Computer Fair launches

Win a Microline printer

spectrum games

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for –

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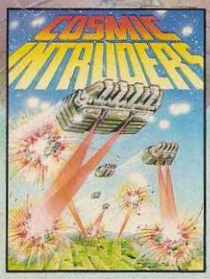
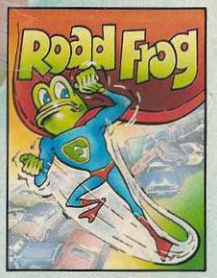
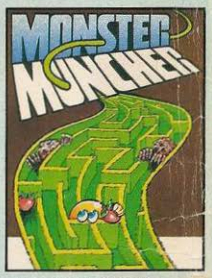


■ COSMIC INTRUDERS
The original and best intruders game with some new twists – *how long can you last?*



■ ROAD FROG
Guide Froggy across the road, then the river and finally home – *but beware the Evil Monster!*

■ ROCKET COMMAND
Speed across the planet surface to defeat the aliens and save the Human race – *smart bombs and hyperdrive to aid you.*



■ MONSTER MUNCHER
Chomp the appies in the maze before the monsters eat you – *if you can swallow the boosters you might even eat them!*

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£5.50 Including, VAT, post & pack and OUR NO QUIBBLE REPLACEMENT GUARANTEE

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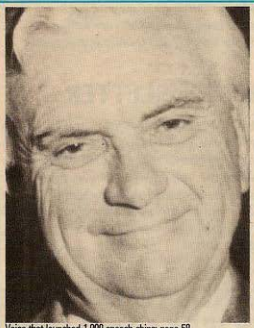
YOUR COMPUTER Contents

JUNE 1983



Voice that launched 1,000 speech chips: page 58.

Vic-20 cover game: page 66.

Spectrum Minefield: page 72.

ZX-81 Quick Load: page 75.

Dragon Flight: page 86.

Cover photograph by Stephen Oliver.

43 **COMPUTER FAIR PREVIEW:** The widest range of home computers ever gathered under one roof; the latest machines, the latest software all at our June Earls Court fair.

44 **EDITORIAL AND YOUR LETTERS:** A way of speeding up or slowing down Vic games; an end to Sinclair loading problems. Why the music men are moving in.

46 **NEWS:** New micros from Memotech, Texas and, believe it or not, Volkswagen; Commodore sweeten Vic-20 prices and Cyborg helps micros unite.

51 **COMPUTER CLUB:** Simon Beesley revisits the hallowed halls of Croydon Central Reference Library and finds London's number two club thriving.

54 **FIRST BYTES:** This month your introduction to computing opens up ports, takes a peek at Pokes and goes down to zero.

58 **BBC SPEECH SYNTHESIS:** All it needs is an autocue — John Dawson listens to Kenneth Kendall's dulcet tones issuing from a BBC Micro.

62 **VIC-20 SOFTWARE SURVEY:** Peter Connor zaps some grids, depopulates a planet and rescues a captured scientist.

66 **SCRAM-20:** Shoot through the corridor of fire in Nalin Sharma's gripping program for the Commodore Vic-20.

72 **SPECTRUM MINEFIELD:** It's a long way back to headquarters, and you have to be careful not to put a foot wrong in David Goodrum's explosive game.

75 **ZX-81 QUICK LOAD:** No more quiet cups of tea while you wait for programs to load. Richard Taylor helps you load more quickly and efficiently.

80 **VIC DISASSEMBLER:** Alan Westwood presents a program, structured so that new functions can be added, to help you slice through hexadecimal.

86 **DRAGON FLIGHT SIMULATOR:** Loop, bunt and roll off the top — yes, you can get airsick in the comfort of your own home thanks to John Nash.

95 **SPECTRUM EDITOR:** Trevor Hill's program provides a user-friendly set of routines that will protect against invalid input.

102 **ZX-81 GAMES — 1K WONDERS:** Rod Hopkins demonstrates once again what can be done in the confines of 1K. Fly a starship or knock down a wall.

106 **ORIC GRAPHICS:** Having pondered in his fastness about the relative merits of Spectrum and Oric, Tim Langdell illustrates early graphics on the Oric.

109 **THIS IS THE VOICE OF THE SPECTRUM:** John Edwards has coaxed speech from the beast, audible without add-ons, or other hardware extras.

111 **BBC SNAKES AND LADDERS:** You need a head for figures as well as heights as you clamber up the rungs and slide down the snakes in Peter Donn's game.

121 **ATOM PLOTTING POWER:** Some software to help Atom owners hold their heads up high when in the company of supposedly better graphic machine owners.

128 **ATARI TIME TRIAL RUN:** How fast is Stan Ockers racing car? Swap the Ferrari for an Atari and leave the rest of the pack eating dust.

134 **DRAGON WORD PROCESSOR:** John Nash takes time off from aerobatics to show you how to configure your text.

141 **BBC TAPE TO DISC:** John Simpson shows how cassette-based programs can be stored on, and run from disc.

147 **CARDS OF FATE:** Chris Somerville ZX-81 prophet.

153 **6502 MACHINE CODE:** Darryl Mattocks' guide.

161 **RESPONSE FRAME:** Tim Hartnell answers your queries.

191 **COMPETITION CORNER:** More puzzles, Texet winner.

163 **SOFTWARE FILE:** 10 program-packed pages full of games, tips and serious applications for the Oric, Atom, ZX-81, BBC, Vic-20, Dragon and Spectrum.

WIN A MICROLINE PRINTER: See card between page 42 and 43.

BOUGHT ANY INTERESTING CASSETTE BOXES LATELY

The Microcomputer Software Club exists to help home micro users to buy good programs – not pretty boxes. Advertisements and clever packaging can make the worst programs appear tremendous. It is not until you have 'gambled' your money that you discover how good they really are. Some are only slightly different to others you may already own; many are not as good as you would be entitled to expect; and others are just a complete waste of money. Of course, there are some excellent programs around, and many more appear each month. Many thousands of home micro users now find out about them easily, safely and regularly. In addition, they are able to buy them at really low prices. They are all members of the Microcomputer Software Club.

FREE MEMBERSHIP

Membership of The Microcomputer Software Club would save you money and trouble. Each month we thoroughly test and evaluate the many programs issued by the growing number of producers – including IJK, Bug-Byte, A & F, Campbell, C-Tech, Imagine, Lothlorien, DJK, Salamander, Bridge, and the smaller companies that you may find it difficult to keep track of. If a program is good, and it has got to be very good, it is recommended to our members in the next issue of the Newsletter.

NO OBLIGATION

Members are not obliged to buy a fixed number of programs from The Club. They buy what they want when they want. Whether it is one program in a year or one a month, they know that when they buy from THE MICROCOMPUTER SOFTWARE CLUB they are buying the best programs at the best prices.

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All programs are, at least, 10% cheaper than normal and, each month, the best of the most recent software is made available to members at 20% less than normal. Postage and packing is free on orders of two or more programs for delivery within the UK; ordering and payment are simple, and quality is guaranteed.

FREE NEWSLETTER

Our latest Newsletter offers programs from most leading suppliers – and from a few that, perhaps, you do not yet know. A program has to be good, very good, before it is recommended to members. It also has to be reliable and, even before the members' discount, it has to be good value for money. Subject coverage includes adventure, arcade, education, strategy games, household applications, family games, business, utilities and programming aids.

CLUB EXPANDS TO INCLUDE COMMODORE 64 AND ORIC USERS

Two excellent new machines have just been added to our coverage – the Commodore 64 and the Oric. Software for these machines will be in our next Newsletter. Remember, membership is completely free of charge and you are under no obligation to buy anything from the Club unless you really want to. If you use a ZX81 (16k), Spectrum (16k or 48k), BBC (A or B), Dragon 32, Vic (expanded or unexpanded), Commodore 64 or Oric, you should join THE CLUB.

JOIN TODAY

THE MICROCOMPUTER SOFTWARE CLUB
P.O.Box 166, Oxford, OX2 9BJ, England.

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Free membership application

Please accept my application and enrol me as a member of The Microcomputer Software Club. I understand that membership is free of charge.

As a member I will receive the Club Newsletter free of charge and will be entitled to benefit from any savings offered to members on selected programs for microcomputers. I may cancel my membership at any time.

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COMPUTER MODEL _____ COMPUTER RAM _____

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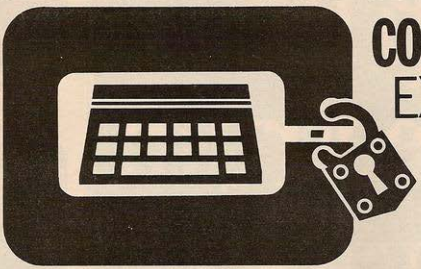
Now you can have complete protection against breakdown after the expiry of your manufacturer's guarantee!



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Declaration

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The June Top Ten in Spectrum software at W. H. Smith.

Flight Simulation
Sinclair
48K **£7.95**

Penetrator
Melbourne House
48K **£6.95**

The range of software available for the Sinclair Spectrum is to say the least, extensive.

So every month at W. H. Smith, we review the range with particular reference to presentation, challenge, excitement and value for money. And because we're quite severe it's a difficult job finally to arrive at a Top Ten. But as you can see, not impossible.

You don't have to take our word for it.

At W. H. Smith we stock the widest selection of Spectrum Software, so you can judge for yourself.

Title	Producer	K RAM	Price
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Space Intruders	Quicksilva	16	£4.95
Time Gate	Quicksilva	48	£6.95
Gulpman	Campbell	16	£4.95
Spectral Invaders	Bug-Byte	16	£5.00
Meteoroids	Softek	16	£4.95
Planetoids	Sinclair	16	£4.95
Hungry Horace	Sinclair	16	£5.95
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Nightflight	Hewson	48	£5.95
Ground Force Zero	Titan	16	£5.00
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Leapfrog	CDS	16	£5.95
Gobble-A-Ghost	CDS	16	£5.95
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3D Tanx	DK Tronics	16	£4.95
Cruising	Sunshine	16	£4.95
Blind Alley	Sunshine	16	£4.95
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3D Tunnel	New Generation	16	£5.95
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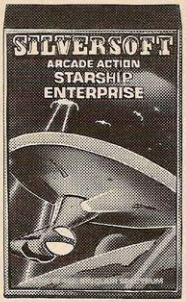
Galaxians	Artic	16	£4.95
Invasion Force	Artic	16	£4.95
Sentinal	Abacus	16	£4.95

Chess
Sinclair 48K **£7.95**



Starship Enterprise
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Silversoft 16K **£5.95**

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Quicksilva 48K **£4.95**

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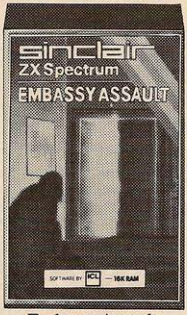

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NEW The External ME16-48K plugs into the back of your Spectrum, suitable for series A & B.

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ATARI

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400/800 SOFTWARE & PERIPHERALS

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3	
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5	£ £
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7	Sales 11786 10944
8	
9	
10	REVENUE EXPENDITURE
11	Purchases 500 500
12	Advertising 500 1000
13	Director's salary 1596 1596
14	Salaries 2216 2216
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16	Telephone 300
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- Comparing rent/lease/buy options.
- Processing the results of scientific experiments or field studies.
- Engineering calculation models.
- In fact, anything that involves repeated re-calculation of results presented in tabular or spreadsheet format.

Program Availability Chart:–

	Database	Text Editor	Mailist	Invoices & Statements	Spread Sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts	Pilot	Trial Accounts
Sinclair Spectrum 16k or 48k	●	●	●			●		●	●	●	●
Dragon 32k or 64k	●	●	●	●	●			●	●		
VIC 20 16k +	●	●	●	●				●	●		
Sinclair ZX81 16k +	●										
Grundy Newbrain	●										
Sharp MZ80A	●	●	●	●				●	●		
Sharp MZ80K	●	●	●	●				●	●		
Sharp MZ80B	●	●	●	●				●	●		
BBC Micro model A or B 32k	●	●	●	●	●	●	●	●	●	●	●
Atari 400/800	●										
Torch	●	●	●	●	●	●	●	●	●	●	●
Epson HX-20	●										
Commodore 64	●										

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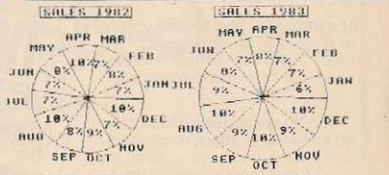

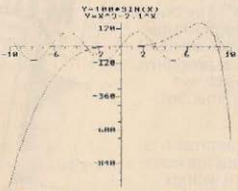

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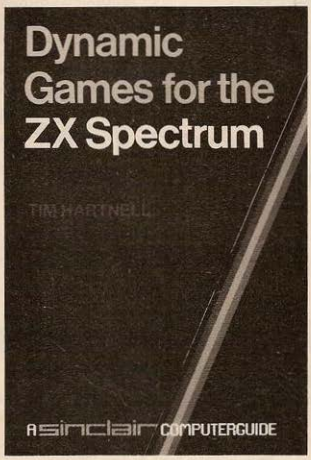

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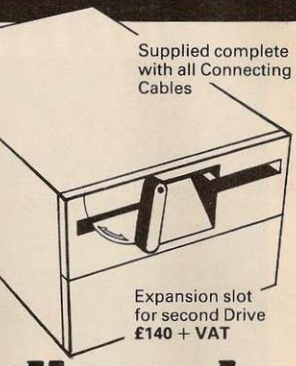

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We are looking for top class writers to join our growing software team. If you have written a quality game for VIC 20, SPECTRUM, DRAGON 32, ORIC 1 or COMMODORE 64, then contact us. We pay top royalties for accepted programmes.

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Dragon Dungeon

DRAGONWARE

Whenever the Dungeon Master reads of competitors' amazement that the Dragon 32 is selling so well "despite the lack of software", he rolls around the Dungeon floor, overcome by hysterical laughter! Send for our 30-page Dragonsoft Catalogue and find out why. (50P, refundable first order).

The Dungeon vaults are fairly bulging with the rush of Dragon software and we now offer the widest selection available in the UK.

Latest Games in stock: Bonka £6.95, Vultures £6.95, Star Jammer £7.95, Night Flight £7.95, Drone '(Tron-type game) £7.95, Ring of Darkness £10.00, The Valley £11.45, Into the Labyrinth £7.95, Pirate £8.50.

Latest Books in stock: The Power of the Dragon £5.95, 6809 Assembler for the Dragon £6.95, Advanced BASIC for the Dragon £6.95, Dragon Extravaganza £5.50, Know your Dragon £4.95.

Latest Utilities in stock: Hi-Res Screen Cartridge (gives 51 × 24 and up to 200 sprites) £25.30, Assembler/Editor/Monitor Cartridge £30.45, Telewriter Word-Processing System & Tutorials £49.95, Salamander Graphics System £9.95.

Coming shortly — Soundbox for monitor users (connect up to your Hi-Fi!).

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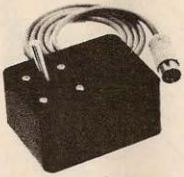


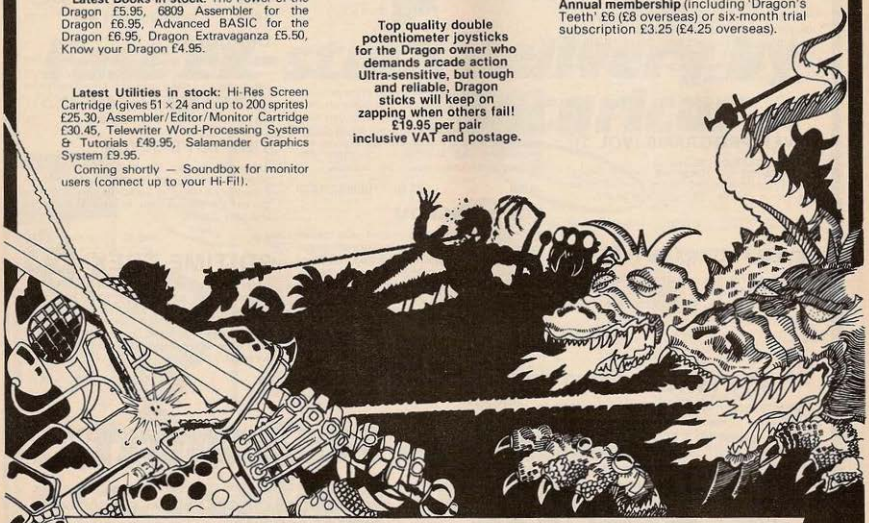
Top quality double potentiometer joysticks for the Dragon owner who demands arcade action Ultra-sensitive, but tough and reliable, Dragon sticks will keep on zapping when others fail! £19.95 per pair inclusive VAT and postage.

DRAGON CLUB

The Dragon Owners Club at the Dungeon is now the largest in the UK (or, since our members range through Europe to the Gulf and Africa, should we say the world?). Members receive copies of the monthly Club Magazine 'Dragon's Teeth', which includes news, reviews and advice, plus monthly offers and competitions. Win a *Year's Free Software* or use the Advice Service or members' free advertising. Badges and Bomber Jackets for extrovert Dragon-bashers.

The June edition of 'Dragon's Teeth' is packed with information and, makes essential reading for any serious Dragon owner!

Annual membership (including 'Dragon's Teeth' £6 (£8 overseas) or six-month trial subscription £3.25 (£4.25 overseas).



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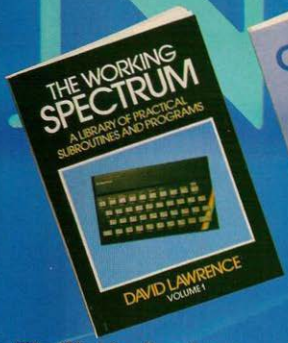

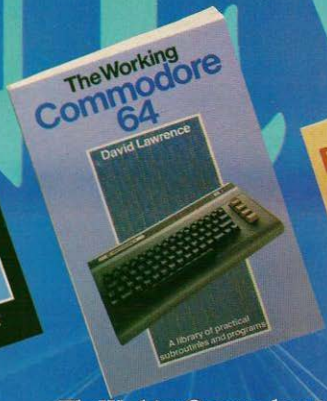

NEW DRAGON USER

Dragon User — the new independent monthly magazine dedicated to putting the Dragon through its paces. Available through your newsagent from May 18 for 60p or take out a subscription for 12 issues for £8.

The Working Spectrum

A collection of sophisticated Basic programs and subroutines including Unifile, Renumber (handles Gotos and Gosubs) education, accounts, games and scores of essential routines. Put your Spectrum to work with what must be the most comprehensive Spectrum book. 248pp **£5.95***

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Some of the more advanced programs in this collection include a word processor and text editor, a music and sound synthesiser, a sprite editor and a program which allows you to enter high resolution graphics mode. This is not available in the standard Basic. 160pp **£5.95**

The Working Dragon 32

This computer has capabilities far beyond most other computers in this price bracket. With this collection of Basic programs and routines David Lawrence introduces word processing, music and shows you how to mix text and high resolution graphics. As with the other books in this series, each program is built up out of re-useable subroutines. 160pp **£5.95***

New from Sunshine

Cruising on Broadway

Behind the wheel of your machine. **Cruising on Broadway.** You look mean. People stop to stare. Suddenly a black-and-white pulls onto the Broadway behind — its light flashing and siren wailing. The chase is on! **Cruising on Broadway** is a tyre-burning fast machine-code game for the 16 & 48K Spectrum. The further you can get the more difficult it becomes — cash prizes are being offered each month for the highest scores. **£4.95***

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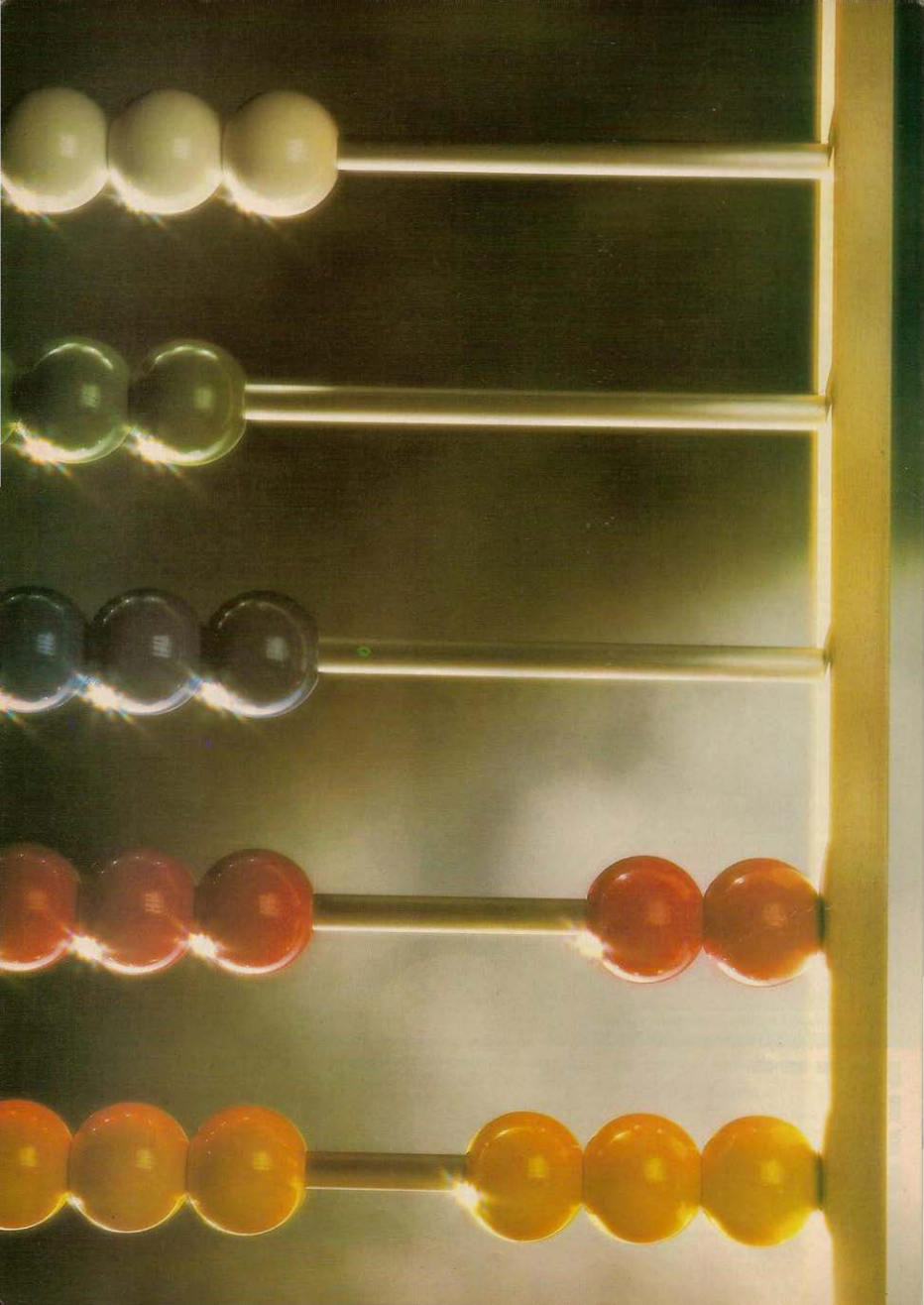

Before we made it clever, we made it simple.

An abacus consists of nothing more sophisticated than pieces of wood on a wire. Yet it makes highly complicated calculations seem like child's play.

Admittedly, the Dragon 32 Family Computer exceeds the capacities of the abacus by a few thousand per cent. And then some.

But at its heart the Dragon is built on the same principle of simplicity. Which is why the Dragon is so easy to learn, and so enjoyable to use.

THE FIRST FAMILY COMPUTER.

The Dragon is designed specifically with the family in mind. So the minute you pick up the instruction manual, you and your children will start to feel at home with your new computer.

The first thing you'll see is that, like the abacus, the Dragon is expert in division, multiplication and all things mathematical.

From then on, expect the unexpected. The colour graphics with their mesmerising whirls and patterns, which suddenly you are able to draw. The five octaves of music. And the range of software.

SOFTWARE TO MATCH.

Dragon software doesn't just offer a great range of games. You'll find educational programs. Programs to help you plan your money. Even programs which teach you how to program.

Your children will soon get their teeth into the big range of arcade and adventure games. And while they're at it, you'll have the satisfaction of knowing that they're coming to terms with the increasingly important new technology in the most painless way of all.

As you can see, the Dragon offers real power and advanced features. It costs just £199.50* which you'll find represents real value for money. And unlike some competitors, it offers a professional-quality keyboard with real keys - guaranteed for 20 million depressions.

You can count on it. And a lot more besides.

SPECIFICATIONS
6809E MICROPROCESSOR. The most powerful eight bit processor available.
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JOYSTICK CONTROL PORTS.

*T.V. not included in price.

DRAGON 32
The first family computer.

Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

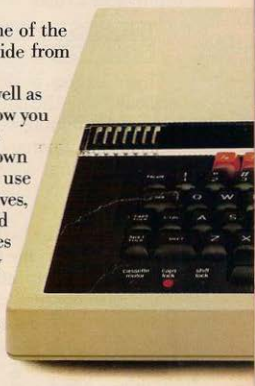
The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.



You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.

A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

The best possible back-up.

Your BBC Micro comes with the backing of the BBC and an extensive dealer and service network.

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If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

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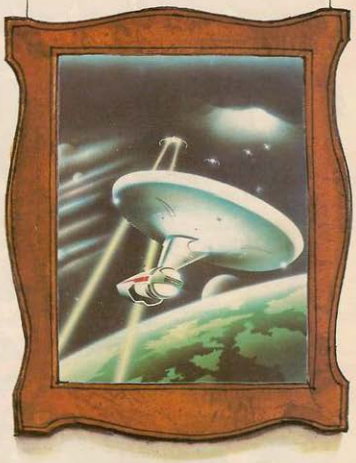

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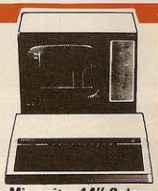

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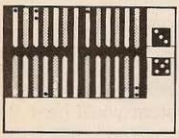

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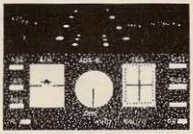

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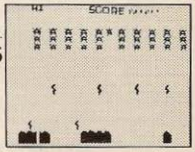

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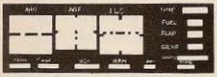

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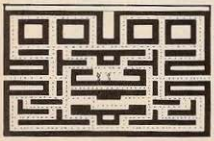

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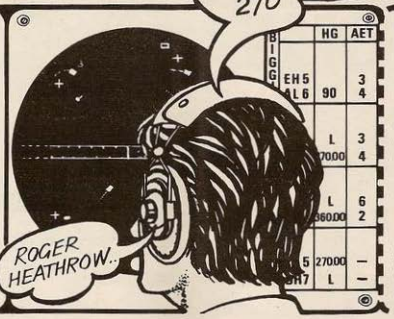

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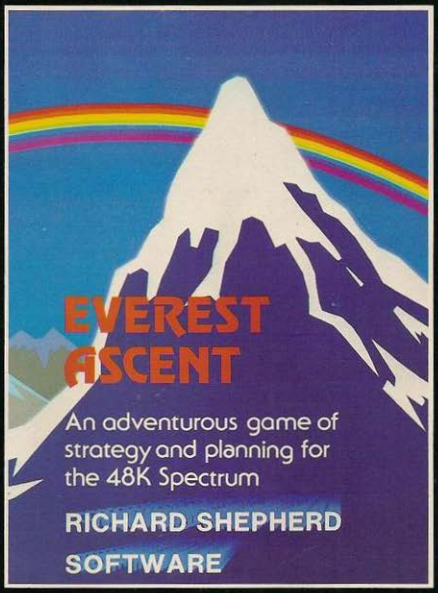

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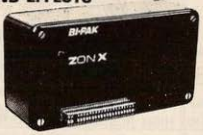

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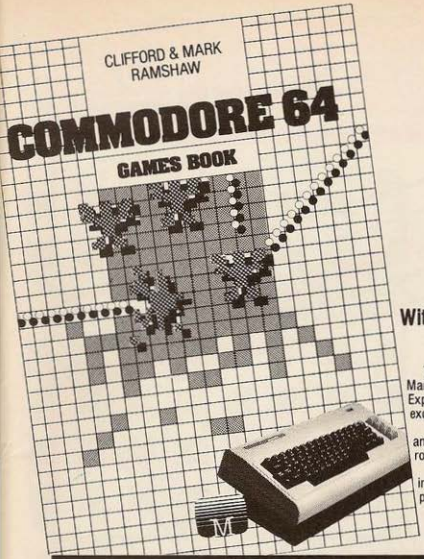

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THE Computer Fair

The Computer Fair will be held at Earls Court from 16 to 19 June. Normal admission prices on the door are £3 for adults and £2 for children under 16 and senior citizens but *Your Computer* readers can visit the fair for a reduced price. A voucher on page 203 offers you £1 off the normal price. Alternatively groups of 20 or more can go in at the reduced prices with a free ticket for the leader of the party. We are also offering combined return rail and admission tickets for adults and children at for instance £5/£3 for anywhere in Greater London and £8/£4.50 from Kent. More details from King's Cross Travel Centre on 01-278 2477. Earls Court is on the District and Picadilly lines and on the 30, 31 and 74 bus routes. There is space in surrounding car parks for 1,300 cars. The fair is open 1pm to 6pm Thursday, 10am to 6pm Friday and Saturday and 10pm till 5pm Sunday.

THE Computer Fair

Why 50,000 people are waiting for Britain's biggest-ever micro show

Relax — these are some of Computer Fair 82's 38,000 visitors — not the beginning of this year's queue.

EARLS COURT WILL be filled with the widest range of home micros and software ever seen in Britain when it hosts our Computer Fair later this month. Last year 38,000 computniks crowded into the fair — so this time we are providing three times as much space.

We will be taking the wraps off several new computers during the show including Memotech's MTX-500. Sinclair's new range of plug-in cartridge software for the Spectrum will be demonstrated in public for the first time. You will be able to hear Acorn's speech chip for the BBC Micro and decide for yourself whether it really does sound like Kenneth Kendall.

A new case for the Ace plus a range of peripherals will be on show from Jupiter Cantab. Camputers will be showing the elegant 48K Lynx but for the moment the company is keeping its lips sealed about the 96K version which its designers are working on.

Texas will be releasing details of the new TI-99/8 at the show and will be promoting the new £50 software package which is being included free with the TI-99/4A. Atari will be there too with the 400 and 800 home computers.

Oric will be at the show with the 48K, and at last 16K, Oric 1 and a new range of software. Have a look at Commodore's new soap-shaped cassette recorder which will now be included in the cost of a Vic-20.

Many of the 250 stalls at the fair will be selling software from all the household names — Bug Byte, Imagine, Quicksilva, Artic, Silversoft and a hundred others. More than 1,000 different games will be on show for home computers.

Because the show is jointly sponsored by *Your Computer* and *Practical Computing* there will also be a considerable choice of serious software — from word processors to finance and accounting packages for all the popular micros.

Ready for gorillas, Micromouse, Club Avenue and Sinclair Village

Last year's Micromouse champion Alan Dibley watching his T3 robot win.

THE COMPUTER FAIR is not just big stands for mighty manufacturers. Look out for Club Avenue — where the major computer clubs are happy to give you advice. Sinclair Village gives you a chance to pick up all those little bits and pieces to make your ZX-81 or Spectrum complete.

The great spectacle of the fair — apart from the programmers who dress up in gorilla suits or *Star Wars* outfits to try to make you buy their programs — is Micromouse.

This is a robot race around a maze. The robots are usually part home computer and part Meccano. You soon find out why these tea-caddy sized automatons have earned names like T3 and Thumper as they try to blunder their way to the centre of the maze before their rivals.

The fastest Micromice on Friday 17 June and Saturday 18 June will qualify for the British final which will be held on the Sunday afternoon. Often the owners of the robots are as entertaining to watch as the little machines themselves. Many a Micromouse has been threatened with a rapid return to the scrapyard after it has failed to live up to the owner's expectations.

The stakes are high because the British winner will be sent with his or her Micromouse all-expenses paid to the international finals in Spain.

Man with a secret

LAST YEAR Clive Sinclair surprised everybody by announcing the world's cheapest colour computer — the Spectrum — at the first day of our Earl's Court Computer Fair. This year he has at least one surprise up his sleeve for us — but is he ready to reveal it?

YOUR LETTERS

THROTTLE CONTROL FOR VIC

This program, to run on any Vic-20 expanded or not, actually allows the user to choose the speed of his program. It adds difficulty levels to any Basic program and thus can give new life to an old game that you have mastered and forgotten, or can improve performance in a business program.

I recommend that the routine be placed at the start of a program — at the end of the instructions is usually a good place. In my program I have not spaced or placed my wording, nor have I set screen and border colours nor even a character colour; you can do this to suit your own needs. Type in Program 1.

A breakdown of this program is as follows: lines 10-60 provide a menu; line 70 sets up the input and gives it the name MD; line 80 checks to see that MD is legal; line 90 prints an error message if it is not, then sends it back to the input. Line 100 is the heart of the program: it Pokes the value MD into the correct location to control the speed.

After running the program you will notice that the speed of the cursor has changed. Actually the cursor's speed is the inverse of what happens during the program. If you

POKE 37879,1

directly into the computer the cursor speeds up yet the program would slow and

POKE 37879,255

slows the cursor, yet speeds up the program. To return the cursor to its normal speed press Run/Stop and Restore.

But is faster always better? What if you have sound and music in your program? Sound will not be thrown out as it usually follows suit with movement in the program, so sound can be forgotten, but music has to be played at the correct speed or it will no longer sound like music. To correct this flaw we must, before playing any music, return the Vic to its normal speed. We do this by

POKE 37879,78

and after the music, we return to the chosen speed by

POKE 37879,MD

typed in after the music. See program 2.

This procedure can also be used to get a program to speed up during a game by a line like:

9999 IF SCORE 1000THEN MD=MD+20

but nothing is perfect, when you change the operating speed of your Vic the real time clock is no longer real time so you must decide between a time-keeper and speed.

Program 1. How Fast?

```
10 CLR:PRINT"00-32 SLOW"
20 PRINT"33-64 SLUGGISH"
30 PRINT"65-128 AVERAGE"
40 PRINT"129-192 FAST"
50 PRINT"193-255 VERY FAST"
60 PRINT:PRINT:PRINT:PRINT
70 INPUT"HOW FAST";MD
80 IFMD>0ANDMD<256THEN100
90 PRINT"CHOOSE AGAIN":GOT070
100 POKE37879,MD
101 the rest of your program
```

Program 2.

```
100 POKE36878,15
115 POKE37879,78
120 FORL=250TO200
    STEP-2
130 POKE36876,L
135 FORM=1TO100
140 NEXTM
150 NEXTL
160 FORL=205TO250
    STEP2
170 POKE 36876,0
180 FORM=1TO100
190 NEXTM
200 NEXTL
210 POKE36878,L
215 POKE36876,0
220 POKE37879,MD
```

Martin Dunn, Johannesburg, South Africa.

STORK PROBLEM

I read with interest Tim Hartnell's reply in *Response Frame* March to C Browning's enquiry on how to differentiate between the 16 and 48K Spectrum. Out of curiosity I peeped into the back of my supposedly 48K Spectrum and then typed in

DIM A$ (40000)

as suggested. I got an out-of-memory report code. Fortunately I live not too far from Camberley and so personally returned the computer in exchange for a 48K. No apology was given and by the string of other people there it seems Sinclair distribution centre must spend more time answering complaints than distributing computers — perhaps this is why it took so long to get one. Although my replacement does not give an out-of-memory report and does run 48K programs, I still cannot find the circular brown object Tim Hartnell spoke of — perhaps he has an earlier model.

A E Straszewski, Petersfield, Hampshire.

CARTE BLANCHE

I recently wrote to the TV Licence Records office to enquire if it was necessary for me to obtain a licence for an unmodified colour television which was to be used only as a computer display unit. They sent me this reply:

"I confirm that a television licence is not required if you are only using your television set as a computer display unit. If you receive any outside broadcasts a licence will be required. Our records have been amended. I trust this clarifies the situation for you."

J A Shield, Witham, Essex.

EASY TO LOAD

As a regular reader of *Your Computer* since its first issue I am amazed at the number of letters from readers with loading ZX-81 problems. It seems to me a case of the blind leading the blind. There is really no problem. All that is required for successful 100 percent loading is a well-modulated tape free from noise clicks and dropouts, the correct signal level neither too weak nor too strong and, providing the tape head is correctly aligned, and free from dust, the program will load. Unwanted noise is usually either already recorded on the tape or is picked up from the mains by the cassette player. A number of letters point to the TV as the culprit. But in my opinion this is rare, any transformer, especially a power supply is a more likely suspect. Sinclair Research say the optimum peak voltage for the tape signal is two volts but must be between 1 & 2.5 volts. Too little voltage and the ZX-81 does not hear it. Too high a voltage, and clipping, harmonics and information degredation follows. To the problem. This brilliant little device will cure problems at a stroke. The silent lead-in part of the tape will show up as not being silent if the tape is too noisy to load: it indicates the optimum two-volt peak signal level is correct and it also indicates too high a signal level. It shows up badly modulated tapes and enables one to adjust the volume control for optimum conditions. If the tape is loadable you can load it. Unlike the meter-type loading aid which does not identify peak voltages but only one's an average and therefore virtually useless readings. It gives the correct peak signal level. I really despair that so many still suffer problems: I am surprised it has not been mentioned *Your Computer.*

T C Rowbotham, Cumbria.

A BIT USEFUL

A useful command on the Sinclair Spectrum, but not available on the BBC, is the bit command which converts numbers from 0s and 1s binary. Here is a small procedure for the BBC which will do the job. The function

FNBIT (B%)

converts a number B% from binary 0s and 1s into decimal and is a simple example of recursive programming.

```
DEF FNBIT (B%)
IF B% MOD 10>1 THEN = 0
IF B% = B% MOD 2 THEN = B%
ELSE=FNBIT (B%DIV10)*2+B%MOD
2
```

Martin Glass, Truro, Cornwall.

ATARI BUG SAFARI

I own an Atari 800. Since I bought it I have discovered a number of bugs in the software. Some of those are documented by Atari, some come in a handout issued with the software, some can be found in the magazines, others I have never seen mentioned in print. I have recently found a number of quirks while developing a large Basic program with assembler routines; quirks which I shall investigate at a quieter time. I have therefore finally asked Atari whether they have a list of known bugs they can issue on request. I was told they have not. No-one expects mainframe levels of support from micro manufacturers and, in many cases, bugs cannot be fixed because they are in Rom. But I take the view that manufacturers should be at least prepared to tell their customers what is wrong. I can imagine all those novices out there finding their Atari Basic program from time to time being lost on deleting a line, or corrupted on amendment, and wondering what's hit them. If you and your readers are interested I am prepared to collate errors and quirks so that you could publish them, with additions on an occasional basis. If this catches on, could we start with Basic and Assembler — other readers, other software? Since this would not be a debugging service correspondence would not be entered into and bugs should be somewhat documented. Certainly I would try to reproduce the error, and would put them to Atari for comment before they are published. I am sure users of other machines have the same problems. Perhaps publicity will persuade the manufacturers to improve their services and even, who knows, actually fix the bugs.

David Andrew, London, E17 9ES.

UNIFILE FAN

Just a word of appreciation for David Lawrence's excellent ZX-81 Unifile program in the April issue, for which I have already found several useful applications.

I have come across only one bug, in connection with amending data, which I think is perhaps worth correcting.

In the 4K file version, amendments do not return the amended entry if the display search item is the item amended, or if an entry is amended after stepping along the file using Newline. Both these cases can easily be corrected by the insertion of one additional instruction:

```
955 LET S$ = Q$
```

In the 9K file version there is an additional problem, in that S$ has been used for moving blocks of data, when it is already in use as the search parameter. This again can easily be corrected by substituting, say, M$ for S$ in lines 1890, 1900, 1990 and 2000 only.

Nevertheless a most useful and versatile program for which many thanks indeed to David Lawrence.

John Cutting,
Hampton,
Middlesex.

TELETEXT

On page 154 of the new BBC User Guide it states that the function keys when pressed in conjunction with the shift key produce a teletext control code, but this feature is not available on the 0.1 version of the operating system, so I wrote this simple program. Type it in as listed and then run it. The function keys will now perform as listed on page 154 of the User Guide — without pressing the shift key. To test it, type in as a direct command

```
PRINT"XXDEMO"
```

where XX is just a single depression of f1 and f8. The result should be Demo flashing in red. These control codes only work in Mode 7. To save these keys on tape type

```
*SAVE"KEYS" 0B00 + 00FF
```

It is useful to note that after defining a set of functions for the user keys they can be saved in the previous manner and re-loaded at any time with

```
*LOAD"KEYS"
```

This leaves any program already in memory intact.

```
 10 REM TELETEXT KEYS BY
    T.J.MATSELL
 20 C=17
 30 FOR K = &0B00 TO &0B09
 40 ?K=C
 50 C=C+1
 60 NEXT
 70 FOR K = &0B0A TO &0B11
 80 ?K=C
 90 NEXT
100 C=128
110 FOR K = &0B12 TO &0B1B
120 ?K=C
130 C=C+7
140 NEXT
```

Timothy Matsell,
Lincoln.

EDITORIAL

IN THE PALACES of the pop industry even the razzmatazz cannot hide the fact that sales of records have been in decline since peaking in the late seventies. Meanwhile in another sector of the nation's economy business is on the up and up. A tidy £1 million per month is one estimate of the size of the U.K.'s market for ZX Spectrum software. Working out the value of the whole home computer software market is what has been producing out-of-range errors on the software houses' pocket calculators.

Given these two contrasting tales of gloom and boom you need not be an industry pundit to grasp why major record companies such as Virgin and K-tel are moving into the lucrative business of selling software. Virgin Records has launched Virgin Games, and K-tel attended the Midland Computer Fair with £1 million in its pocket to negotiate deals with the software makers.

Now that some of the music industry's marketing and distribution power has been turned on the software business, can we expect to see national software charts — and the hyping that goes with them — computer programmers as stars, and Jimmy Savile taking Top of the Software Pops towards its first 1,000 episodes?

The first impact will probably be far less glamorous than that. It could affect the way we buy software.

New records usually get their first exposure on the radio. But because most software is sold through mail order, the first you hear of the computer cassette you order is the dull thud as it lands on the door-mat. Of course you can return it if it is not quite what you wanted. But it would be much easier if you could try out and buy the program in a local shop.

The music companies have the distribution networks to put software in the shops. That development could spell the decline of the mail-order software business. The price for entry into the program market will soar if computer software decamps to the high street. At the moment it is possible to start selling a few programs of a reasonable quality with a mail-order advertisement in *Your Computer*. With the arrival of the big boys from the music industry TV campaigns advertising a range of software could become commonplace. Some argue that the upshot of all this will be fewer software houses in a year's time.

Until now the name of the software writer has not mattered much — each game is judged on its own merits. One major software house recently confided to *Your Computer* that it even deliberately omitted programmers' names from cassette covers. It was afraid that its writers would be poached by rival firms. If marketing and distributing computer programs starts to involve the techniques the music industry uses, the programmer could become more important in selling the product. Could we even see famous names in computing advertised as the authors of the latest software which have in fact been written by teams of skilled but anonymous session programmers?

Imagine turning on your television only to see a perfectly-manicured Clive Sinclair beaming through the soft focus as he sits at the keyboard of his white Spectrum. In true Richard Clayderman style a relaxed voice-over coaxes you to enter the World of Clive Sinclair — a game for every mood.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Why not give it a try? You have nothing to lose but your postage.

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Chartbuster K-tel's million pound bid for home computer games

CHARTBUSTER K-tel is serenading the software houses to the tune of £1 million. That is how much the record company, renowned for its TV-advertised compilation albums, took to the Midland Computer Fair to sign up distribution deals.

The first program maker to succumb to K-tel's overtures is DK'tronics which won an order to supply £150,000's worth of software.

Virgin Games — the Virgin Records offshoot which is the other recent venture from music land into computer games — is buying up the copyrights to new programs. In contrast Adrian Moulds, K-tel's software manager prefers for the moment partnership agreements.

K-tel wants DK'tronics software, not its peripherals.

Companies like DK'tronics develop programs and keep the copyright while K-tel distributes the software through the vans that service the 5,000 outlets for its record business. With a distribution network on that scale it is clear that K-tel believes that future software industry battles will be won in the high street. "The phase of selling by mail order is almost over" says Moulds. He compares the excitement over computer games with the early days of pop music, but he does not expect ace programmers to become like pop stars because "software is not the personality, visual thing that music has become."

Nevertheless do not be surprised if you see a sophisicated TV campaign this Christmas extolling the virtues of K-tel's 20 greatest computer game hits. K-tel's attitude to TV advertising might also be applied to its view of the software market now. "It's not for amateurs" says Adrian Moulds. "The stakes are very high."

David's Sharp Welsh tongue

FORGET FORTH, Logo and Pascal, the language your micro really needs is Welsh. John Loverseed has just written a Welsh Basic for the Sharp MZ-80K and MZ-80A, and he has been amazed at the response from computer fiends in Wales. When, they want to know, will they be able to buy Welsh Basics for their Spectrums, ZX-81s, Vic-20s and Bridgend-built Dragons?

Many of the enquiries have come from bilingual schools which want to teach computing in Welsh on their BBC Micros. Unfortunately they may have to wait because Loverseed has taken advantage of a feature of the Sharp which is unusual for a home computer. Every time you use the MZ-80 you have to load in the Basic from tape to disc.

This can be a mixed blessing but it has made it very easy for Loverseed to adapt Sharp Basic and sell his Basic Cymraeg on tape. He has simply substituted Welsh words and abbreviations for the pseudo English of Basic. So, instead of Goto, Basic Cymraeg uses *Mynd* meaning "to go". It would be more difficult to implement Welsh versions for those home computers whose Basics are resident. Sharp Basic Cymraeg is available from David Computer Services 38 South Parade, Bramhall, Stockport, SK7 3BJ.

Micros of the world unite with Cyborg's software translator

THE SECRET FOLLOW-UP to Cyborg's all-micro disc drive will break down the barriers that stop software written for one micro running on another. The French company is developing hardware which will allow all machines with the same central processor unit, or CPU, to share software.

Cyborg's priority is a unit for the 6502 CPUs used by most micro-makers. By early next year you may be able to run Vic software on a BBC Micro or on an Oric. Later a Z-80 version will be produced for Sinclair owners.

Cyborg's crusade against the idiosyncrasies of home computing with a 760K disc drive that will work with all home micros. Jean Garutti, the man behind Cyborg, expects to sell 100,000 of these units a year, but adds that the figure could "increase explosively". The 5.25in. drive costs £250 and, at the change of a connector and the insertion of a floppy disc, will work with your machine.

That floppy disc holds a "grammar" which describes the micro to the drive's disc-operating system contained in a ULA. Details of the computer's pin-outs, I/O, ROM and RAM maps, and the areas of memory available are contained in the grammar. Grammar discs and cables for the ZX-81 and Oric have already been produced, and the Spectrum, BBC Micro and Atari will have theirs next month. Dragon, Vic-20, Commodore 64 and TI-99/A and Lynx owners will be able to use the single-sided, single-density drive by September. Each disc can hold 240 entries, and file names can be up to 18 characters long.

Texas TI-99/8 will offer 80K for £300 and can speak for itself

WITH 80K FOR £300 Texas Instruments new TI-99/8 is going to shake the micro market. *Your Computer's* American spies have already glimpsed the all-new 16-bit machine before its official launch. The TI-99/8 has built-in speech and can even read text out aloud.

The micro will have a high-resolution colour display and the kind of keyboard you would expect on a £1,000 machine. In addition to Basic, Forth and Logo, UCSD Pascal will be available soon after the TI-99/8 goes on sale in Britain in the late autumn.

The TI-99/8 will spearhead the new wave of Texas micros which has swept away the company's reputation as the slumbering giant of home computing. The CC-40 portable computer we reviewed in May is already selling well. TI-99/4A sales have taken off since the price was dropped to £150 and now Texas offers a £50 package including two joysticks a game cassette and an elementary Basic tutorial cartridge free with every TI-99/4A sold.

The TI-99/4A will be reskinned to look like the new TI-99/8.

Far from killing off the TI-99/4A, Texas is planning a reskin for the machine later in the year which will make it look more like the CC-40 and the forthcoming TI-99/8. Simplifying the internal design and better product engineering will allow Texas to reduce the price of the machine even further before Christmas. The £70 TI-99/2 black and white Basic tuition computer may now be upgraded before Texas launch it in September.

Mace — an assembler, editor and system monitor — sits at the top of RAM leaving enough room for a Basic program to be developed on the Dragon at the same time as machine code. It comes on a ROM cartridge and costs £29.95 from Windrush Micro Systems, Worstead Laboratories, North Walsham, Norfolk, and selected Dragon dealers.

Memotech MTX-500 understands Noddy

FRONT PANEL DISPLAYS like an Austin Maestro's dashboard, and a language called Noddy mark out Memotech's new 48K micro from the sub £300 crowd. Sprites and 16 colours in high-resolution are also part of the attraction.

Until now Memotech has concentrated on selling peripherals for the ZX-81. So it is no surprise that like the Sinclair the new micro — the MTX-500 — will be Z-80A based. Memotech will demonstrate the MTX-500 at our June Computer Fair and production will begin in August.

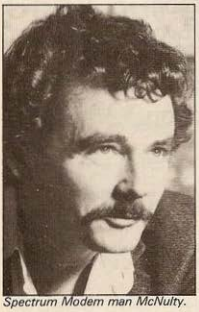
The new micro has a solid black aluminium case with a full 79-key keyboard including a numeric keypad and eight function keys. 16K of Rom will include Basic, an assembler and a disassembler. 32K of RAM will be available to the user and there will be alternative languages such as Logo, Forth and Pascal together with Noddy — a new language aimed at schoolchildren.

Display will be 40 columns with an 80-column option and there are outputs for TV and RGB monitor. If you lose your way in a program or just want to check what is happening you can call up a front panel display which gives details of the status of the program, on the right-hand side of the screen. Memotech designers Geoff Boyd and Robert Branton claim that the MTX-500 can produce 16 colours in high resolution — which is 256 × 192. Two joystick ports and a Centronics interface are built in and there is an RS-232 option. Three-channel sound is output through the TV — like the Vic-20 — rather than through an internal speaker.

The MTX-500 will be made in Witney, Oxfordshire by Memotech. For further details of the computer contact Memotech on 0993-2977.

Long distance information — try McNulty Spectrum Modems

SPECTRUM OWNERS will soon be able to enter the world of telecommunications — John McNulty has announced a Spectrum Modem for £50, and from July Micronet will be selling a Prestel adaptor for £90. The first 10,000 subscribers to Micronet can buy the adaptor now for the subsidised price of £50.



Spectrum Modem man McNulty.

With McNulty's Modem the Spectrum can be used to access world-wide databases, an electronic mail service, or simply to communicate with other Spectrums. The Modem, which can both answer and originate, is direct-connect and runs at 300 baud.

For £200 John McNulty is offering a Spectrum Starter Pack which includes a 48K Spectrum, the Modem and the RS-232 interface needed to connect the two. He describes it as providing people with the chance to learn about telecommunications at a fraction of the cost of a full, purpose-built terminal.

The Micronet package consists of all the necessary hardware and software to turn the Spectrum into a Prestel terminal — a direct-connect Modem, the interface circuitry and 8K of software in ROM — is housed in a box the same size as the Spectrum which fits underneath the machine.

It needs to be plugged in to a telephone socket and connected to the back of the Spectrum via a ribbon cable. On power-up, the software converts the Spectrum's display from 32 columns to 40-column Prestel format.

The system is menu-driven and includes some unusual facilities.

Volkswagen folk's micro

VOLKSWAGEN which invented the people's car is now producing micros for the people. VW subsidiary Triumph Adler is moving downmarket from business systems to produce a 64K £400 micro.

The PC comes complete with Centronics and RS-232 interfaces. There are TV and RGB monitor outputs, and games cartridges can be plugged in. The PC has a full-size, 79-key typewriter keyboard but although eight colours are available on screen the highest resolution possible is only 160 by 72.

Casio's latest piece of wallet-sized one-upmanship is the FX-802P pocket computer — which even has its own built-in printer. A QWERTY keyboard gives the option of single-key entry for Basic commands. The FX-802P can handle up to 10 separate programs with a total of 1,568 steps. A separate numeric keypad makes calculation easy. For a start you could work out that at £99.95, the FX-802P works out cheaper than buying one of the old pocket computers plus a printer.

From laser zaps to dead frogs Microl peps up your programs

IF YOU ARE TIRED of writing slow, boring Basic games and too lazy to get to grips with Z-80 machine code Microl have an idea to help you cheat.

An innocently-titled cassette called Game Effects contains a whole range of sneaky machine-code routines which you can call into a Basic program to produce high-speed spaceships, explosions and seven million sound effects. John Peel of Microl admits that six million of the sound effects are pretty well indistinguishable but, as he says, there is still plenty of scope for "police sirens, helicopters, laser zaps, dead frogs and that sort of thing." Special visual effects and screen mixes are also part of the pack.

How Good is your Spectrum

If you're interested in finding out what your Spectrum can really do when pushed beyond the limits of standard BASIC, then your machine could be a reality with CRYSTAL COMPUTING MACHINE CODE UTILITIES.

Zeus Z80 Assembler

If you are a 48K Spectrum and want to exploit the potential of your computer to the full, then Zeus is the ideal introduction into machine code programming. For the beginner, Zeus is the ideal introduction and easy way to understand and develop machine code programs.

- Full screen editor, with cursor control, insert, delete, copy, move, search and replace.
- User Manual - with detailed explanations of assembler terminology and Z80 instructions.
- Over 60,000 bytes of machine code program space.
- Assembler - with full, accurate and detailed error reporting.
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- Tape Utilities - for loading, verifying, copying and listing of tapes.
- Multi-page machine code programs - allowing machine code programs to be loaded and executed from any page in memory.
- Relocatable Linker - for combining machine code modules.
- Relocatable Loader - for loading machine code modules into any page in memory.
- Communicate - with other machine code programs in memory.

For the experienced user, Zeus is simply the fastest and most flexible Z80 programming system available today. The high speed two pass assembler, with powerful macro facilities, and the extensive range of utilities, including memory editor, disassembler, linker, loader, and communicate, ensure that Zeus is the ideal development system for all machine code programs.

The Zeus Z80 operating system - more than a piece of software - an investment.

- 9 invaluable monitor support facilities, including memory editor, disassembler, linker, loader, and communicate.
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- Relocatable Loader - for loading machine code modules into any page in memory.
- Relocatable Linker - for combining machine code modules.
- Communicate - with other machine code programs in memory.
- The Utilities - a range of powerful utilities, including memory editor, disassembler, linker, loader, and communicate.
- Operations - display, modify, move, search and compare.
- Up-Grade - allows the Zeus operating system to be used with other machine code programs.
- Monitor - allows the Zeus operating system to be used with other machine code programs.

available NOW from Crystal Computing.

Spectrum Monitor & Disassembler

A superb memory editor, monitor and disassembler to enable easy entry, inspection and analysis of any machine code routines. Fully compatible with the Spectrum ROM, it allows machine code routines to be developed, debugged and analysed. Many of the routines in the ROM can be used by the machine code programmer, thus saving time, space and effort. Features include:

- Memory Editor - allows the user to examine and modify any memory location.
- Disassembler - allows the user to disassemble any part of memory to tape or printer.
- Tape Utilities - for loading, verifying, copying and listing of tapes.
- Multi-page machine code programs - allowing machine code programs to be loaded and executed from any page in memory.
- Relocatable Loader - for loading machine code modules into any page in memory.
- Relocatable Linker - for combining machine code modules.
- Communicate - with other machine code programs in memory.

A machine code system designed to provide a powerful development environment for machine code programs. Suitable for the beginner and the experienced user, it provides a high degree of flexibility and ease of use.

ZX-81 Superfast Load & Save

Each utility comes complete with user manual for use on the ZX-81 and Spectrum.

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Alternatively, try our own range of exciting and original ZX games:

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Bring your Spectrum to life with the most naturalistic dirbuster type action game ever seen. Your task is to destroy the alien mothership, but it is not easy. The alien has a powerful defence system, including mobile laser cannons, and a fleet of fighter craft. Your only weapon is a single laser cannon, providing more than enough firepower to destroy the alien craft, but not enough to destroy the mothership. Fast action, high resolution graphics, and an amazingly difficult game, make this one of the most exciting games you've ever seen. Introductory price of only £5.50.

The Dungeon Master

Let the 48K Spectrum take your guide into a new dimension of adventures as the best program to date is released on the Spectrum. Descend into an ever-changing dungeon, fraught with dangers and pitfalls, and battle your way through an eternity of fantasy worlds. This was the DUNGEON MASTER, could you survive the unique DUNGEON CREATION PROGRAM? Needless to say, it is a program you've ever seen, for endless hours of action packed fun at for just £5.50.

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YOUR COMPUTER TOP 20

Game	Company	Machine
Arcadia	Imagine	Spectrum
Arcadia	Imagine	Vic-20
Black Crystal	Carnell	ZX81
Bonzo	Audiogenic	Vic-20
Choplifter	Creative Software	Vic-20
Donkey King	Microdeal	Dragon
Dragon Trek	Salamander	Dragon
Flight Simulator	Psion	ZX81
Football Manager	Addictive Games	ZX81
Galaxians	Artic	Spectrum
Gridrunner	Llamasoft	Vic-20
Gulp 2	Campbell Systems	ZX81
Hobbit	Melbourne House	Spectrum
Miner 2049er	Big Five	Atari
Penetrator	Melbourne House	Spectrum
Planet Invasion	Microdeal	Dragon
Rocket Raid	Acornsoft	BBC
Space Pirates	Bug Byte	BBC
3D Tanx	D K Tonics	Spectrum
Zaxxon	Datasoft	Atari

Cut and thrust in the price war as Sinclair reveals £99 Spectrum

SINCLAIR'S PRICE CUTS have sparked another micro war. The £25 reduction which has taken the 16K Spectrum below the £100 barrier has put pressure on Oric, while bringing the 48K Spectrum down from £175 to £130 has provoked a quick reaction from Commodore.

Now the £140 recommended price of a Vic-20 will include a £100 package of extras. The £10 cut in the cost of ZX-81s and ZX Printers to £40 has made the bottom end of the market less attractive for new micro companies.

Ironically Oric is having difficulty producing 16K machines for the original £99 price and was considering raising the price to £125 before Sinclair dropped its prices.

ZX-81 now £39.95

Spectrum now £99.95 for 16K, £129.95 for 48K.

Sinclair spokesman Bill Nicholls denied that the £99 price tag on the Spectrum was forced on Sinclair by Oric's pricing strategy. He said "This will keep us well ahead. It is not in reaction to anybody."

Psion Scrabble beats writers with 11,000 word memory

PSION'S SCRABBLE program for the 48K Spectrum consistently beats the programmers who wrote it. At the highest level it typically scores around 300 points in a two-player game and takes an average of 90 seconds to respond.

Scrabble costs £26.95 and was written under license from Little Genius who produced the disc-based version for the Apple II computer.

Some very clever compression techniques have been used to give the program a vocabulary of 11,000 words.

This is not as large as the average human vocabulary but includes the sort of nifty little words like "gnu" and "ai" that Scrabble players will find particularly useful.

New recorder free with Vic

COMMODORE'S RESPONSE to recent price cuts is not to cut Vic-20 hardware prices to £99 — as rumoured earlier this month — but to introduce a new software deal and include the cost of the dedicated recorder in the overall price.

Commodore's trendy design team has come up with a replacement for the Datasette dedicated cassette unit which was the £45.95 hidden cost of buying a Vic.

Commodore describes the new C2N unit shown above as "sturdy and more visually appealing".

The software deal consists of five cassettes — four games and one introduction to Basic. For £139 you get software and equipment worth £250 at old Commodore prices.

Shell out less for a turtle with Zeaker's two-tone seeker

MICRO-TURTLE is a robot which you can plug into any home computer. The £80 Zeaker Micro-Turtle can be controlled by your micro through a ribbon cable. It has a built-in retractable pen so that it can draw shapes on a piece of paper under keyboard or program command.

It can also be programmed to roam around the floor — and when it collides with an obstacle it will sound one of two notes on a horn depending on which side it has touched. After the collision the Zeaker sets off in another direction.

Colne Robotics which makes the Zeaker also produces a kit version for only £60. The Micro-Turtle can be plugged straight into a BBC Micro or any computer with an eight-bit bi-directional port. A £15 interface allows it to be used with the ZX-81 or Spectrum. Colne Robotics is on 01-892 8197.

Arcade aces turn to micros to produce Jet Pac and Pssst

TAKE BRITAIN'S most experienced arcade game design team, set them loose on the home computer games market and you might expect to see some very high quality software. The team in question have formed a new company, Ultimate Play the Game, which has just released its first two, Jet Pac and Pssst, for the Spectrum.

Tim Stamper, one of the four directors of the company, believes their experience in the highly competitive arcade business will give them an edge over other software houses.

They previously designed games — building the hardware as well as writing the programs — for one of the largest arcade game distributors distributors in the States.

Ultimate Play The Game aims to produce a new game every two weeks. As Tim Stamper explains: "We have a lot of concepts just waiting to be programmed."

Juggling with figures is what Neil Hooper is more used to. But now his company Micromega is adding games titles to its list of tax avoidance and personal banking programs for the ZX-81 and Spectrum. That's why he is spinning Roulette, Monte Carlo, Gulpman, Brainstorm and Dominoes cassettes through the air. Soon Micromega will also launch a range of space trader games which incorporate the challenge of Adventure games and the specific skill tests of landing on hostile planets or beating off attacks by invaders. It is all a long way from Comp-U-Tax, the do-it-yourself tax calculation program which established Micromega in the Sinclair market. Except when they are in the park you can find Micromega's juggling gypsies on 01-223 7672.

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Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.

CROYDON REVISITED

Number two tries harder and Croydon Computer Club — the second largest in London — certainly does. Simon Beesley found the club thriving since *Your Computer's* last visit — and he also found out about robot ping-pong players, chip famine and static electricty.

Budding starship commanders try out a new BBC game at Croydon Central Reference Library.

WHEN *Your Computer* visited Croydon Computer Club nearly two years ago it was described as definitely thriving. It is clear that the club has continued to expand. The second largest club in London, it now boasts 150 paid-up members with a further 50 or so associate members. In the spirit of the Association of London Computer Clubs, the club is almost evangelical in its fervour to spread the gospel of computing. It is well represented at computer fairs and shows, is involved in local computing projects, and has had a hand in starting up some of the new clubs in the South London area.

One of the penalties of size is that the first of the club's two regular monthly meetings is somewhat lacking in the intimate atmosphere found at smaller clubs and has more the air of the public lecture. The second meeting, however, is given over to special interest groups which pursue such activities as programming in 6502 and Z-80 assembler.

When *Your Computer* visited the club the chairman, Vernon Gifford, announced that he was making his basement available to the Hardware Group and invited members to enter the 1983 version of the Micro Mouse competition. Rather than build a robot mouse which can find its way about a maze, contestants this year will construct a robot ping-pong player.

Being a large club, Croydon can attract high-calibre speakers. George Mell, who designed the computer graphics for the film *Alien*, had given a talk at a recent meeting and at this meeting almost 100 people had turned up to hear Neil Cryer talk about the BBC computer and its applications.

As it turned out Neil Cryer was unable to appear and his place was filled by Bob Foster from the Richmond Computer Club. He gave an off-the-cuff talk which contained various tips and pointers. Starting with a demonstration of Prestel on the BBC he then illustrated the transfer of programs from tape to disc. Miscellaneous topics touched upon included nylon carpets: the static electricity they generate — he warned — could damage a computer.

To demonstrate the Prestel adaptor Bob Foster had stored a number of Micronet's pages on disc. He was lucky enough to have Acorn's second version of Basic on board and he explained how one of the new commands, Oscli, made it easy within a short program to load any page off disc.

Croydon's BBC owners have been less fortunate in getting hold of peripherals and the latest operating systems. In the discussion afterwards, members revealed that they were suffering from the Great Acorn Chip Famine. The disc controller chip is in very short supply and the disc interface cannot be had for love nor money.

Evenings such as this one, devoted to a particular machine, are just one part of the Croydon club's calendar. Future events include talks on word processors and choosing a micro, and a disc symposium. The club meets in the Central Reference Library, Katherine Street, Croydon on the first and fourth Tuesdays of each month. ■

Local society news

Stockton workshops

STOCKTON Amateur Computer Club meets every Monday at the YMCA in Stockton, Cleveland, from 7.00pm to 9.00pm. Meetings alternate between evenings devoted to programming and workshop and games evenings. Over 12 months the club has built up a membership of 60, and among them are owners of most makes of home computer. For details contact Peter Cheshire on 0642-784819.

Thriving in Iver

THE IVER Computer society powered up for the first time on May 12th and now meets bi-monthly on the second and fourth Thursdays in the Huntsmoor Room at Iver Village Hall. The club caters for every level of enthusiast, from those just about to start to those already bitten by the bug. Contact John Haigh on Iver 654431 for details.

South Avon club formed

A MULTI-USER home computer club has been formed for the whole of the South Avon district. Regular meetings in Nailsea are planned as well as extra computer workshop meetings and a bi-monthly magazine. For more information contact the Secretary Valerie Boyde-Shaw on Nailsea 851337.

Micros of Penzance

FORSAKEN by Prestel and desperately short of dealers, is how the Penwith Area Computer Club describes the plight of the computer user in that part of Cornwall. The new club aims to promote computer literacy in the area and to stimulate the user of computers in local education. It meets every Friday in a room above the Penzance Micro Centre. Prospective members should phone Steven Zenith on Hayle 754845 or Paul Whitehead on Penzance 66336.

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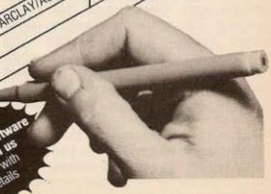

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QUESTIONS

What exactly is a port?

'Can you explain to me exactly what, in computer jargon, the word port means? What are they used for? What types of ports are there? Which are the most common? How do joystick and printer ports work and in what way do they differ from user ports? Do all home computers have ports, and, if they do not, can they be added?'

IN COMPUTER jargon the word "port" means a point of connection between the internal workings of the computer and the outside world. Equipment connected to a port becomes the computer's eyes, ears and hands.

There are several different types of port. Some are designed for specific peripherals such as disc drives or printers, others are of more general use and are referred to as "user ports".

The most common types of ports on home computers are the user port and ports for joysticks and printers. Printer ports usually come in one of two varieties. The parallel or Centronics type has eight data output lines and some control signals for "handshaking" between the computer and the printer. Handshaking is the term used to describe an exchange of signals between a computer and an external device. A handshake dialogue could go like this: the computer sends a byte of data to the port and follows it with a control signal which tells the printer "there is new data at the port". In turn the printer reads the data and sends a control signal back which says "I've read that byte, send me another".

The second type of printer port is the serial or RS-232 port. This sends data a bit at a time in a packet of eight bits along a single wire. Extra hardware at each end of the link converts the serial packet to a byte. Several other types of device can be attached to printer ports — for example, speech synthesisers or sound generators.

Joystick ports usually connect to an analogue-to-digital convertor which allows analogue input voltages to be read by the computer. The joystick produces an output voltage proportional to its position. This voltage is converted to a number which represents the joystick's position. Other devices producing output voltages such as electronic thermometers can also be connected instead of a joystick, giving the computer the ability to measure external conditions.

Unlike the joystick and printer ports, which are fixed as input and output ports respectively, the user port is bi-directional — it can be configured to Read or Write, under software control. This has one main advantage.

Because of its versatility it can be connected to a variety of devices — robots, heating systems, train sets are some of the possibilities that spring to mind. Sinclair even claimed that the ZX-80 could be used to run a nuclear power station!

Not all home computers have a full complement of ports and Sinclair computers, in particular, have none of the ports described. But they can usually be added by plugging in interface boards.

Parallel printer interfaces, for example, are available for the ZX-81 and Spectrum, and an RS-232 board for the Spectrum should arrive soon.

John Simpson

BEATING ZERO

ARE YOU going for zero bugs in your program? Do you have zero bugs in your code? Have you ever thought seriously about zero? Nil? Nothing? Nought? And have you thought about why these can cause and are problems? It is no wonder the computer has difficulty dividing by nought — have you ever tried it?

I could do that...

There is a popular word game which involves forming as many words as possible from the letters of a single six-letter word. Write a program to assist you in this task. It should accept a six-letter word as input and print out four letter word anagrams. Each anagram must contain at least one vowel and one consonant.

The winning program in April's multiplication problem came from K Reid, 126 Clayton Road, Chessington Road, Surrey. From a large number of entries this one managed to squeeze a solution into the fewest number of lines.

Please send your entries clearly marked "First Bytes Competition" to *Your Computer*. First Bytes competitions are judged two months after they are set, the closing date for entries is the last working day of the month in which the competition appears.

```
10 DIM A(24)
20 INPUT X$,Y$
30 FOR M=0 TO 11
35 FOR N=0 TO 11
40 C=M+N
50 A(C)=A(C)+VAL(MID$
   (X$,12-N,1))
*VAL(MID$(Y$,12-M,1))
60 I=INT(A(C)/10)
70 A(C)=A(C)-I*10
80 NEXT
90 NEXT
100 FOR P=23 TO 0
    STEP-1
110 PRINT A(P);
120 NEXT
```

POKES

PEEK AND POKE are two Basic commands which beginners often have problems with, although they are really very simple. They differ from most Basic in that they act directly on the numbers stored in computer memory. When you Peek into a memory location the result is the number stored there. The easiest way to see this is to run the following simple program:

```
10 FOR N=1 TO 255
20 PRINT PEEK(N);
30 NEXT N
```

which will display the numbers in the first 255 memory locations. Note that you must

```
PRINT PEEK
```

if you want to see the numbers, and that the values you get will depend on the way the memory is organised in the machine you are using.

Often the low memory locations contain the Basic interpreter, so you are looking at the numbers permanently fixed in ROM — Read Only Memory. If you have the memory map for your machine look for the memory location where program storage starts, for example 16514 on the ZX-81, and then change line 20 so that you start Peeking from that point. For example:

```
20 PRINT CHR$(PEEK(16513+N));
```

You should now see something more recognisable, as you are actually looking at your program. As you are now using

```
CHR$(PEEK)
```

you get the character representations of the numbers, but do not be too surprised if it does not look exactly as you wrote it. There are always hidden instructions in the program which are not displayed when you List it.

If you Poke a memory location you try to put the number you have specified into that byte. If you Poke into RAM — Random Access Memory — then you will succeed, but Poking ROM will have no effect; remember it is Read-Only. Look at your memory map for the start of the screen display, and try Poking the screen with different numbers.

```
10 S=(screen start address)
20 FOR N=1 TO 255
30 POKE S+N,N
40 NEXT N
```

You should now see a whole range of different alphanumeric characters, and perhaps also keywords and graphics characters, appear on the screen.

As Peek and Poke give direct access to all of the memory they can be very useful, as they can reach the parts other Basic cannot reach. For example, certain locations will contain system variables which tell the machine where your program starts and ends. If you Poke different numbers into these locations you can fool the system into thinking that things are not as they really are. For example Poking RAMtop on the ZX-81 allows you to reserve space for machine-code programs. Some dialects of Basic have Deek and Doke, which are just like Peek and Poke, except that they deal with two memory locations at a time, so they are useful when changing addresses — which take two bytes:

```
X=DEEK(1)
```

will tell you the 16-bit number in locations 1 and 2, which you must find otherwise with

```
X=PEEK(1)*256+PEEK(2)
```

Keith and Steven Brain

THE BUGS ERRORS

One of the most natural errors to do with zero is the infamous "divide by" one. Not, you understand "divide by one", but "divide by zero".

This most commonly occurs in iterative loops where the program is performing some division operation on a variable that is being incremented or decremented each time round. The tragedy occurs when the unfortunate variable reaches zero. The program tends to fall over. Crash. The simplest solution to this is to introduce range checking on your variables. The loop itself should obviously do some of this for you, but adding in extra explicit checks for zero yourself can save debugging time.

Of course, historically, zero is a problem too. Let's face it, historically, zero did not even figure, and, no doubt partly because of its comparatively recent appearance on the number scene, zero is hard to teach and even harder to learn.

It is difficult to represent zero of anything in a realistic way, and this can lead to understandable confusion; a recent example discovered in a pre-release of an up-market educational program illustrates this. A child was given a selection of coloured objects and had to decide whether there were more reds than blues, more blues than reds, or equal numbers of both, and send them down a labelled chute. It was an extremely disconcerting moment for the child presented with a blank screen and asked to make a decision. Of course the correct decision — red equals blue — was not intuitively obvious. As a postscript to this it is interesting to note that this zero-zero possibility was taken out of the game before release.

A typical computing problem with zero is that most machines will automatically initialise a variable to zero. This, in itself, is not a problem; it is the programmers' lamentable forgetting facility that causes the problems. If a variable is used and a zero input would be correct, then even if no input is given the variable will contain zero — that is, a correct value.

Another problem, possibly the commonest of all is that computers count from zero — the bits in a byte are indexed from 0-7, the elements in an array are usually indexed from 0 up to the size of the array minus one, and strings are just inconsistent; sometimes they are indexed from 0 upwards, sometimes from 1.

Strings have their own special zero related problems: what is a nul string? What do the actual bytes representing that string actually contain? Nuls. It is obvious but what does it mean? And before the zero-slash combination arrived who could tell at a glance whether it was the letter O or the digit 0 being referred to? Try typing

```
LET A=O
```

— the letter not number — in Basic and see what happens. If you are lucky it may take your letter O, take it as a variable, initialise it to zero and make A equal to zero. If you are unlucky your program will fall over.

All in all, zero is quite a problem. However, it can become less of one if you are aware of it, and arm yourself against the dangers. It helps if you count from zero yourself, it helps if you initialsie your variables explicitly, it helps if you put in extra range-checking and value tests, but most of all, it helps if you think like your computer.

Piers Letcher

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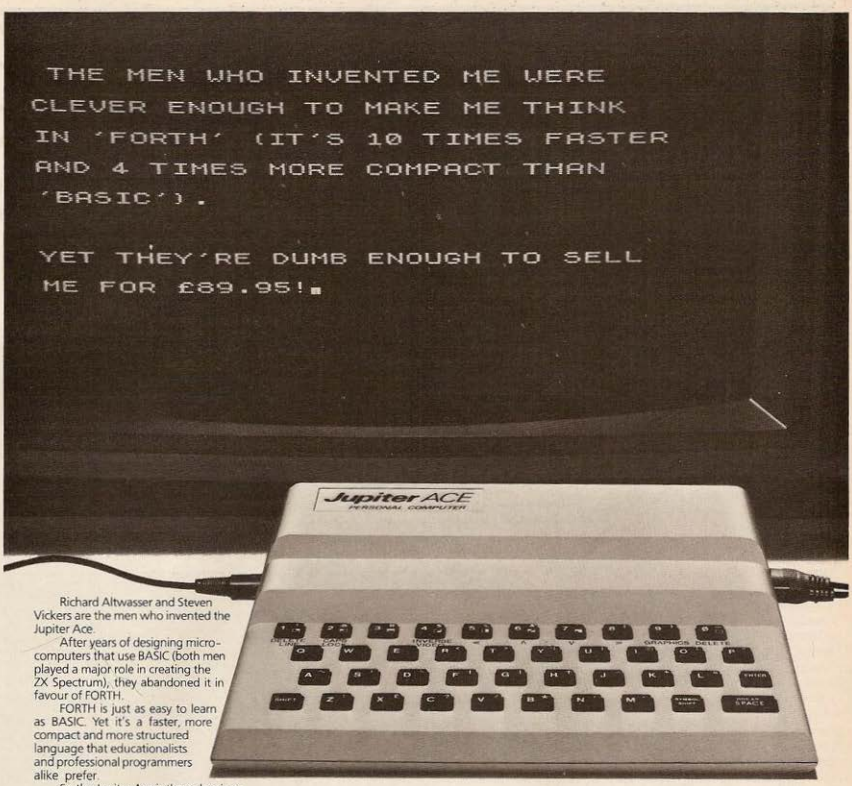

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It'll take you no time at all to realise how clever Richard and Steven were to design the Jupiter Ace around FORTH. And even less time to realise what a silly price £89.95 is to charge for it.

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BBC SPEEC SYNTHESISE

Former newscaster Kenneth Kendall's voice has been captured on silicon for the £55 Speech Synthesiser, the new arrival in the BBC Micro's family of add-ons. John Dawson listens to the patter of its tiny beeps.

MY BBC MICRO now speaks BBC English — and it comes as no surprise to discover that its new urbane accent is modelled on ex-newscaster Kenneth Kendall's voice. The BBC Speech Synthesiser behind this development consists of two chips that plug on to the main printed-circuit board. In the future the ROM cartridge socket to the left of the keyboard will allow more predefined words to be added to the 165 words and word-parts held in the first onboard ROM. The Speech Synthesiser itself and the first ROM are available now and cost £55 which includes fitting. Acorn has coined a new piece of jargon — the chip containing the words and bits of words is called a PHROM, which stands for Phrase Read-Only Memory.

The Speech Synthesiser can be controlled from both Basic and assembly language. It is easy to use in Basic programs but things become increasingly complex as you move into assembly language and access the words in the PHROM, and even more difficult as you start to create your own words in RAM.

If you have a fast analogue-to-digital converter you can sample human speech as it occurs and then turn the varying electrical waves into digital numbers which can be stored on a gramophone record, a video cassette or in a computer. While this method gives the highest quality reproduction, the disadvantage is that colossal quantities of numbers are needed to store all the samples required to recreate the original sound.

Computer speech synthesis is largely concerned with the struggle to cut down the quantity of information — the digital numbers that you have to store to reproduce intelligible speech.

Human speech is a very complex affair. Several parts of your mouth and throat are involved in making the sounds that form each word. If you open your mouth and breath out you will hear a rushing sound without any recognisable characteristics. However, try closing your lips to form an "O" while keeping the cavity of your mouth open and then breathe out again. The quality of the sound changes and should now appear to be more "tuned".

The cavity in your mouth has reduced the amplitude of some frequencies more than others and has limited the range of the previous "white noise" sound. In the same way you can experiment by holding your throat gently while saying "No" and "Get". There is much more activity in your throat when you pronounce "Get", while "No" is produced mostly at the front of your mouth by your teeth and lips.

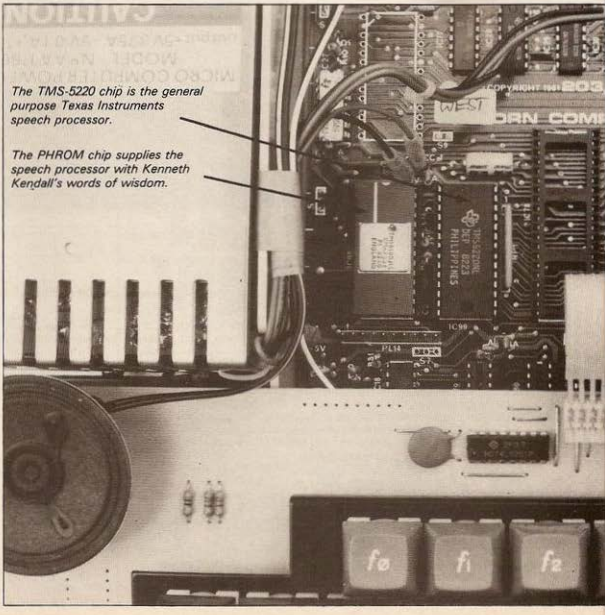
Speech can be recreated by recording someone speaking certain words, and then reducing the words to numbers. This method can achieve a high quality of reproduction but is limiting because one is confined to using the words originally stored in the system. Furthermore finding the word in an electronic dictionary in real time would soon become impossible using the speed and processing power of microcomputers. Proper names or new words would defeat the system completely.

The alternative is to break English speech down into its component parts and then reassemble them to make up words. The component parts are called phonemes and there are about 42 of these sounds in ordinary English. Other languages such as Japanese, Russian or Arabic have quite different sets of phonemes.

It is possible to break down ordinary text into significant groups of letters and then look up the corresponding phonemes for each group. These letter groupings are called "morphs" and Professor Allen of the Massachusetts Institute of Technology has identified 8,000 morphs that will describe at least 95 percent of the words in typical texts.

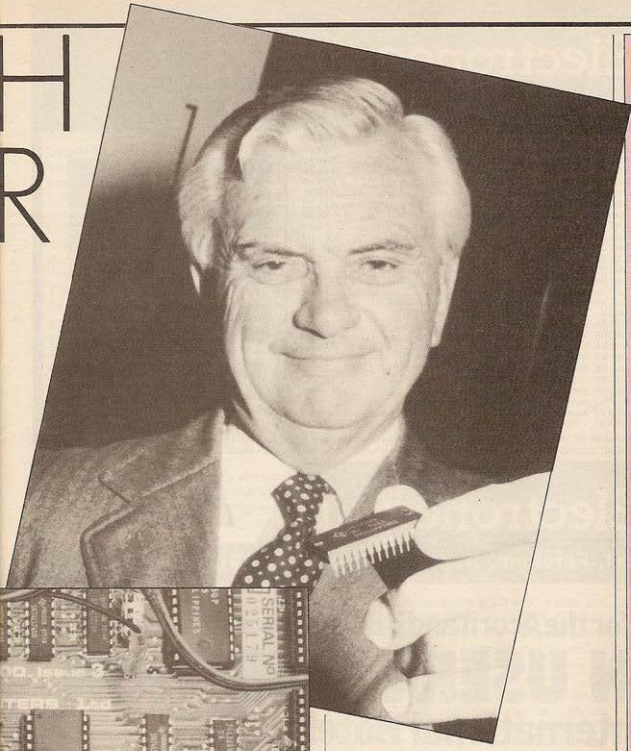
The Texas Instruments speech processor, TMS-5220, used in the BBC Speech Synthesiser is a general-purpose digital model of the human vocal tract. It can, therefore, be used either to pronounce complete, prerecorded words or to pronounce phonemes chosen by the computer's software to speak any word in the language.

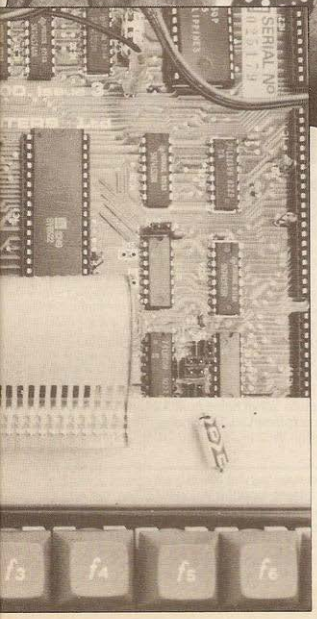
The first PHROM supplied with the BBC Speech Synthesiser contains a number of complete words and some "word-parts" — not phonemes — that can be used to extend the range of the vocabulary. Another PHROM could be substituted for the first, or plugged into the cartridge ROM socket, containing the 42 phonemes in English. With the appropriate



The TMS-5220 chip is the general purpose Texas Instruments speech processor.

The PHROM chip supplies the speech processor with Kenneth Kendall's words of wisdom.





software the BBC computer would then have an unlimited vocabulary.

While you or I may find a Texas Speak and Spell machine bearable for 10 or 15 minutes at a time, an aircraft controller may be quickly fatigued by having to listen to compressed, distorted speech for the whole of an eight-hour shift. Clarity is not merely a cosmetic extra — it may be vital for the safety of an operation. The signal-to-noise ratio is important; it is tiring to have to drag the sense of what is being said to you from a lot of background noise. My BBC computer has a fair degree of buzz when it is "at rest" but I thought the Speech Synthesiser with the Acorn PHROM produced clear sound, particularly when a number of words were assembled into a sentence. The context in which the words were pronounced also made understanding easier.

For good reason Acorn insists that the job of fitting the Speech Synthesiser should be carried out by a dealer. The latest issue printed-circuit boards are correct but issues 1, 2 and 3 require some minor changes to a few address lines. Series 4 boards require no modification.

(continued on page 61)

REVIEW

Figure 1.

Word or word-part number	Word	Word or word-part number	Word
		209	Is
127	(0.125)	210	J,Jay
128	(0.25)	211	K
129	(Tone 1)	212	Key
130	(Tone 2)	213	L
131	-d	214	Large
132	-ed	215	Last
133	-ing	216	Line
134	-s	217	M
135	-teen	218	Many
136	-th	219	Minus
137	-ty	220	More
138	-z	221	Must
139	Zero	222	N
140	Hundred	223	Name
141	Thousand	224	Negative
142	One,won	225	New
143	Two,to,too	226	No,know
144	2- (twen-)	227	Not,knot
145	Three	228	Now
146	3- (thir-)	229	Number
147	Four,for,fore	230	O
148	4- (for-)	231	O'clock
149	Five	232	Of
150	5- (fif-)	233	Off
151	Six	234	Old
152	6- (six-)	235	On
153	Seven	236	Only
154	7- (Seven-)	237	Or
155	Eight,ate	238	P,pea
156	8- (eight-)	239	Parameter
157	Nine	240	Pence
158	9- (nin-)	241	Please
159	A	242	Plus
160	Acorn	243	Point
161	After	244	Positive
162	Again	245	Poun-
163	Amount	246	Press
164	An	247	Program
165	And	248	Q,queue
166	Another	249	R,are
167	Answer	250	Red
168	Any	251	Reset
169	Available	252	Return
170	B,bee,be	253	Run
171	Bad	254	Running
172	Between	255	S
173	Both	256	Same
174	Button	257	Score
175	C,see,sea	258	Second
176	Cassette	259	Small
177	Character	260	Start
178	Complete	261	Stop
179	Computer	262	Switch
180	Correct	263	T,tea,tee
181	D	264	Ten
182	Data	265	Thank
183	Date	266	That
184	Do	267	The
185	Dollar	268	Then
186	Don't	269	Third
187	Down	270	This
188	E	271	Time
189	Each	272	Try
190	Eleven	273	Twelve
191	Engaged	274	Type
192	Enter	275	U,you
193	Error	276	Uh
194	Escape	277	Up
195	F	278	V
196	Few	279	Very
197	File	280	W
198	First	281	Want
199	Found	282	Was
200	From	283	Were
201	G	284	What
202	Good	285	Which
203	H	286	X
204	Have	287	Y,why
205	I,eye	288	Year
206	Illegal	289	Yes
207	In-	290	Your
208	Input	291	Z

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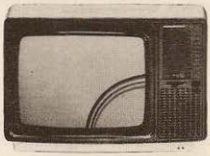

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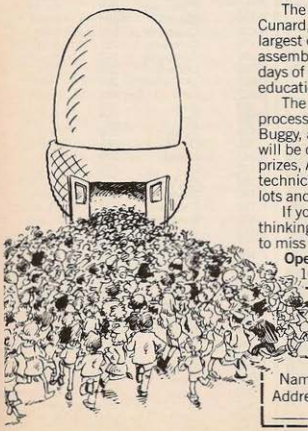

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(continued from page 59)

I confess that I would not have minded paying, at their risk, someone else to make the two or three circuit changes necessary because the printed-circuit board tracks that have to be altered are small and close together. Additionally, the instructions suggest that the Speech Synthesiser should be set up using a frequency meter to ensure that the pitch of the voice is correct.

Words are spoken by the Speech Synthesiser using a special form of the Sound command, and the ordinary uses of sound are not disturbed. The speech Sound command for the first PHROM takes the form:

SOUND –1, variable, 0,0

The –1 identifies the PHROM. Alternatives for the first number direct the speech generator to use a word from RAM instead of a PHROM, or choose a different PHROM. The second number — variable — selects the word to be spoken in one of three ways.

Either the word number in the PHROM is given, absolutely or as the result of evaluating an expression, or an ASCII character can be used to identify the word. The third method of identification uses the address of the word within the PHROM.

The last two zero parameters are necessary to maintain the syntax of the Sound command. There is no way of varying the volume of the Speech Synthesiser using software instructions.

The words in the PHROM supplied with the speech generator are set out in figure 1. Note that although there are a collection of complete words, there are also a set of word-parts such as:

-ing	-s
-d	-z
-th	in-

These can be added to other words in the collection to form new words like:

In- ten -d
Have -ing
Enter -ing
Enter -d

The instructions supplied with the two chips contain a great deal of useful information and two programs which demonstrate how the Speech Synthesiser can be operated from either Basic or assembly language.

At the most primitive level the notes suggest that you should type in

SOUND –1, word number, 0, 0

for almost every sound you wish to produce. This quickly showed me just how easy the chips were to control and it took less than five minutes to write the following program to speak a complete sentence:

```
10 REPEAT
20 FOR K = 1 TO 11
30 READ L
40 SOUND -1,L,0,0
50 NEXT K
60 RESTORE
70 UNTIL FALSE
80 DATA 205,167,131,267,198,271,275,246,
   131,267,174
```

The data in line 80 are the word numbers that make up the sentence "I answered the first time you pressed the button". Hardly a contribution to a Hemingway manuscript, but nevertheless an amazing technical achievement.

Figure 2, taken from the user instructions, illustrates some of the additional words that can be made up using word-parts from the vocabulary. Words like "seethe" and "witches" are clever examples, and you will be able to experiment for hours to explore the range of the chips' capabilities.

Figure 2. Some compound words made using word and word-parts.

Eye	I
Eyes	I -z
Feud	Few -d
Files	File -Z
Filed	File -d
For,fore	Four (4)
Fuse	Few -z
Goods	Good -z
Having	Have -ing
Inbetween	In- between
Incomplete	In -complete
Incorrect	In- correct
Indeed	In- d -d
Inner	In- uh
Intend	In- ten -d
Jay	J
Jays	J -z
Keys	Key -z
Knew	new
Lasted	Last -d
Lasting	Last -ing
Lined	Line -d
Minuses	Minus -z
Moor	More
Moors	More -z
Names	Name -z
Naming	Name -ing
News	New -z
Nose	No -z
Numbered	Number -d
Numbers	Number -z
Once	One -s
Pea	P
Peas	P -z
Pleases	Please -z

You can input a series of numbers into an array and then play the array through the Speech Synthesiser, automatically calculating the number of words to be pronounced. At a more serious level you may succeed in chopping off the front sections of words to create new word-parts. This can be done by sending a reset code to the Speech Synthesiser which halts the speech output in mid stammer, so to speak, and then continues with the next word in the queue.

In this way it should be possible to obtain the "w" sound at the beginning of "were", adding "-uh" and "-d" to obtain the conditional word "would". Approximately 20 words can be held in the queue, and after processing the instruction, the computer will go about its business while it simultaneously speaks the stored sentence.

Spoken words are an output device just like a visual display unit. Speech is a way of communicating information from the machine and in some circumstances it will be more useful, or safer, to attract a person's attention using speech than by flashing a message on to a VDU.

The main difference between the two is that a VDU displays a good deal of information simultaneously while a speech generator presents information serially — that is, one word after another. It can be difficult to grasp the content of a letter if it is read to you over the telephone because you cannot see the whole of a page at one time. Tables of figures may make a pattern from which you can gain important information; presented serially, you would struggle to create a picture in your mind. These problems affect everyone who is blind or seriously visually handicapped.

Normal vision is severely limited in a photographic darkroom and here, and in other similar environments, communication by speech can be a valuable, time-saving aid. Ear, nose and throat surgeons, working through microscopes in the tiny spaces of a patient's middle ear might usefully obtain information from a speech generator as might a pathologist counting cells of a particular type in a blood film. Electronic engineers who have rushed headlong into digital voltmeters might well appreciate the new freedom of looking at the piece of equipment under test or the service manual while voltages are spoken to them by a voltmeter.

CONCLUSIONS

- The limited vocabulary of the BBC Speech Synthesiser is due to the present phrase read-only memory or PHROM. Up to 16 PHROMS can be identified by the speech command — Sound -X,word,0,0 — and, in theory, those chips can generate speech in any accent you choose, and with either a defined or an unlimited vocabulary.
- Kenneth Kendall's English accent is a great relief after all the American imports of the past. Not only is the sound more pleasant to listen to, I think it is also easier to understand.
- The first PHROM contains a useful set of words with some important omissions. Obvious words such as "left" and "right", "north", "south", "east" and "west" would all have been useful additions.
- I would have liked to have heard some conditionals in the set, perhaps "would" and "could", as well as words to do with human interactions such as "like" or "people". The subtlety of the sentences that you could have produced would have been increased greatly.
- That criticism is easy to make in retrospect — by and large the set of words and word-parts will be enormous fun for games players as well as offering substantial help to computer users who are visually handicapped.
- Chopping words in the PHROM to obtain new word-parts is unlikely to appeal to many people but I confidently foresee add-on PHROMS and "dictionary discs" being made available from several sources.
- The Speech Synthesiser fits neatly inside the BBC case and it is easy to add a socket to connect a large speaker to the internal amplifier. Overall, a versatile and successful addition to the range of Acorn BBC peripherals. ■

Take your seats for the software sensation of the century. Bask in the reflected glory as Peter Connor gives the latest programs the big screen treatment.

Company	Game	Memory	Joystick/ Keyboard	Price
Llamasoft	Grid-runner	U	J	£6.00
	Traxx	8/16K	J	£6.00
	Laser Zone	8/16K	J	£6.00
	Abductor	U	J	£6.00
Software City	Defender on Tri	8/16K	J	£9.95
	Exterminator	U	J	£6.99
	Vikman	U	J	£6.99
Rabbit	Night-crawler	U	J	£9.99
	Space Phreaks	U	J	£9.99
	Quackers	U	J	£9.99
	Skramble	U	J	£9.99
	Hopper	U	J	£9.99
Quicksilva	Trader	16K	K	£14.95
	Tornado	3K	J	£5.95
	Skyhawk	3/8K	J	£7.95
Sumlock	Jumpin' Jack	U	JK	£7.95
	Gridtrap	U	JK	£7.95
	Gunfight	U	JK	£6.95
	Destroyer	U	JK	£7.95
	Scorpion	U	JK	£7.95
Romik	Moons of Jupiter	3/8/ 16K	J	£9.99
	Power Blaster	U	JK	£9.99
Audiogenic (Creative Software)	Kaktus	8/16K	JK	£7.95
	Man-grove	U	JK	£7.95
	Choplifter	C	J	£24.95
	Apple Panic	C	J	£24.95
	Serpen-tine	C	J	£24.95
Anirog	Frogrun	U	JK	£6.00
	Cavern Fighter	U	J	£6.00
	Crawler	U	J	£6.00
Commo-dore	Scott Adams	C	K	£24.95
Pase	Worm	U	K	£4.99

Company	Address
Audiogenic	PO BOX 88, Reading, Berkshire.
Romik	24 Church Street, Slough, Berkshire SL1 1PT.
Quicksilva	Palmerston Park House, 14 Palmerston Road, Southampton SO1 1LL.
Anirog	26 Balcombe Gardens, Horley, Surrey.
Rabbit Software	380 Station Road, Harrow, Middlesex, HA1 2DE.
Llamasoft	49 Mount Pleasant, Tadley, Basingstoke, Hampshire.
Sumlock	Royal London House, 198 Deansgate, Manchester M3 3NE.
Software City	3 Eden Walk Precinct, Kingston on Thames, Surrey.
Commodore	818 Leigh Road, Trading Estate, Slough, Berkshire.
Pase	213/215 Market Street, Hyde, Cheshire SK14 1HF.

ALMOST TWO years after its birth the Commodore Vic-20 has come of age as a games machine. The more imaginative new games reviewed here show that the Vic need not blush in the company of other, comparably-priced machines, thanks not so much to weary old arcade classics, but rather to novelties which boldly go where no game has gone before, seeking out new life-forms for jaded players.

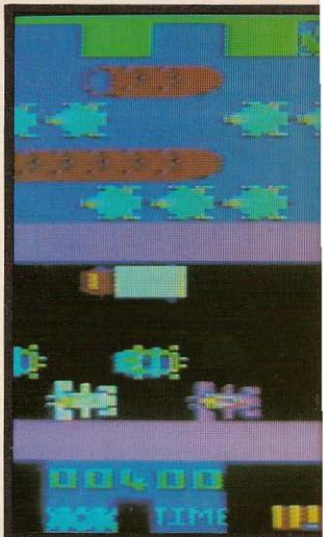
The blasé gamester's interest could be re-kindled by a range of musical introductions. Radio 3 listeners might appreciate Kaktus from Audiogenic, which opens with a few bars of Mussorgsky's *Pictures at an exhibition.* Less highbrow music-lovers might prefer Quackers from Rabbit Software, which repeats, *ad nauseam,* a fairground carousel tune. Those with a penchant for the exotic could do worse than try Creative Software's Serpentine which begins with a sleazy belly dancing tune full of Eastern promise — though it delivers snakes rather than cabaret. For the more avant-garde Vic owner, Pase has produced Worm whose opening sounds are challengingly tuneless.

But the game's the thing, and Gridrunner from Llamasoft is one of the most impressive. This exceptionally fast-mover cleverly develops an essentially simple idea. The screen is filled by a grid of red lines, on the bottom seven of which your ship, the Gridrunner, can move freely. Your opponents are the Droids who swarm down with alarming speed. Additional hazards are the X/Y Zappers which run along the boundaries of the grid emitting plasma pulses and plasma beams; where these meet a Pod is formed. This has to be hit repeatedly to be destroyed. When you have destroyed all the Droids in one wave you see the comforting message, "Grid Zapped". You cannot relax, though, since there are another 19 waves after that. Gridrunner is fast, noisy and compulsive.

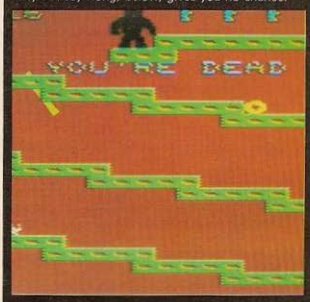
Llamasoft has produced several other games which make the most of the Vic's graphics. Traxx is also a grid game, but here the sectors are quite large. The object of the game is to capture these squares while avoiding bugs that flutter about. Traxx is less frenetic than Gridrunner, but has its own attraction. It requires a delicate touch with the joystick to steer your way around the grid.

Laser Zone is another intriguing idea from the same company. Here you have two ships, one moving along the horizontal axis and the other along the vertical. The object is to vaporise the nasties, best done by co-ordinating the ships and mastering the art of diagonal firing.

Llamasoft's Abductor is an amusing variant on Galaxians. The aliens zoom down as usual, but, and here is the twist, kidnap your humanoids. There's no ransom though; you just have to destroy them before they reach the top of the screen, in which case you get your humanoid back. If you do not destroy them your humanoid becomes a grimy yellow shell which drops on you with unpleasant consequences.

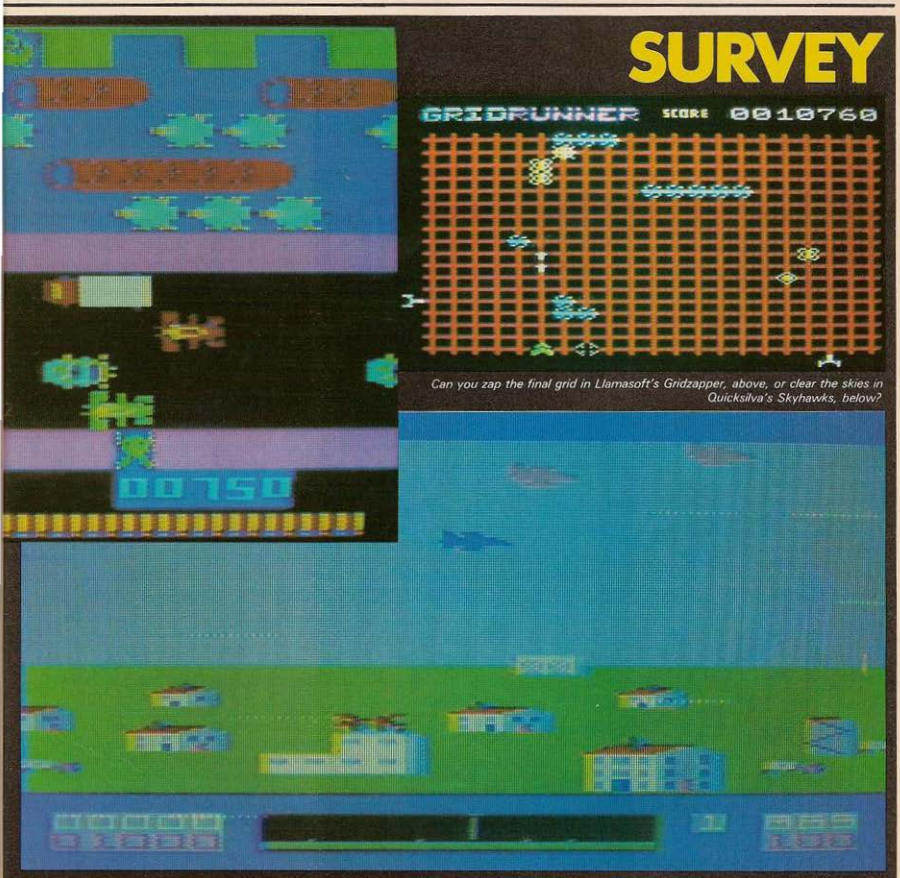


Jumpin'Jack is a flash Frogger, above, while Software City's Krazy Kong, below, gives you no chance.



VIC—2

Defender on Tri — 3K — from Software City, is a novel game in which you pilot a spaceship through a maze to save a captured scientist. To avoid being smashed to smithereens on the walls you must use your shields which are heavy on fuel. You must therefore be skilful enough to pilot the ship without using the shields too much and quick enough to race around gobbling fuel dumps. Having picked up the scientist you exit to the



Can you zap the final grid in Llamasoft's Gridzapper, above, or clear the skies in Quicksilva's Skyhawks, below?

20 SOFTWARE

next page where yet stronger obstacles are encountered. Who can resist seeing if the aliens are meaner on the other side?

Software City also produces a very good version of Centipede, called Exterminator. According to the blurb, the principle of the game is to "Shoot everything that moves and everything that does not", which seems pretty clear. It is a very fast game with shuddering mushrooms and a 200-point snail whose pace is untypically quick for a mindless mollusc.

Vikman, SC's version of Pac-Man, is not the equal of the other two games. Its graphics are rather dull and the game rather slow.

Of the many good versions of Centipede for the Vic the best, by a segment, is Nightcrawler from Rabbit Software. It is exceptionally fast and furious with a plethora of multicoloured creepy-crawlies coming at you both horizontally and vertically. It is one of those games that automatically force the defeated player to cry desperately "I'm sorry, but I've got to have another go".

Not many of Rabbit's other games are up to this standard. Probably best of the rest is Speace Phreaks, a version of Galaxians in which you colonise a new planet and destroy the eponymous aliens. The one drawback of this fast-firing game is the background — the

(continued on next page)

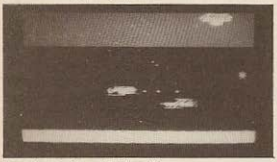
(continued from previous page)
twinkling little stars make it hard to see the alien missiles.

At first sight Quakers also from Rabbit, seems to be an original. A fairground shooting-gallery is colourfully represented, and carousel music conjures up the atmosphere of candy-floss, toffee-apples and muddy shoes. But it does not take long to see through all this; what we have here is a variation on Galaxians with the aliens — in this case, ducks — going quickly across, rather than down the screen. Nonetheless, it is a nice try at something different.

Rabbit's Skramble raises the question of which arcade games transfer well to the Vic. Rabbit's version is as good as anyone else's; which is to say that it is rather fuzzy and unexciting. The sound and speed of the Vic do not seem to be quite up to this kind of game. An intriguing aspect of Rabbit's Skramble, though, is the cutely-named Wiggy Tunnel, a cavern where you are attacked by what looks like extra-terrestrial tumbleweed. It is deadly, all the same.

Hopper is Rabbit's version of Frogger, the game where the frog has to cross road and river avoiding lorries and jumping on logs. This one has good graphics and compares favourably with its arcade relations.

Audiogenic is now distributing three games by the American company Creative Software. These are all cartridges which means they all contain their own extra memory and load very quickly. It also means they cost around £24 each, but some may well consider the extra price worth paying as all three have excellent



Creative Software's Choplifter.

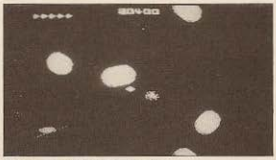
colour graphics and sound. In Serpentine you have to pilot a snake round a maze laying eggs to survive. You also have to avoid other snakes, which like to eat you.

Choplifter is, apparently, a best-selling game in the U.S.A. Here you have to pilot your whirly bird into enemy terrain and rescue hostages. Tanks fire at you, aircraft bomb you and there is a curious flying tin-opener which chops you into little pieces — at which point there is a disgusting splattering noise like the Spam going all over the kitchen. Apple Panic is the weakest of the three Creative games. This is what we British might call Monsters, where you go up and down ladders digging holes for the monster to fall through. I had always thought these were a rogue species of tomato, but apparently not. The instructions have an authentically American flavour: "Once an apple has gotten stuck in the hole, you have to mash it in . . . by beating it over the head". Violence, it seems, is as American as Apple Panic.

Audiogenic has itself also produced Mangrove, an original new game. The object is to defend your cells and allow them to grow. You are under constant attack from microbes and protection is afforded by moving your cells in the optimum manner. You also have three smart pills which, like Domestos, kill all known germs. This is an ingenious game with good graphics, which takes us to the very edge of the struggle for existence. Rubber gloves are not necessary.

Kaktus, also from Audiogenic, is a witty development of the Invaders/Galaxians theme. Here you are a gopher defending a large cactus from attack by hornets and wasps. There is also an unusually aggressive mole which gets you underground. Both these Audiogenic games are welcome because of their originality and quality.

Sumlock's Gridtrap is another interesting newcomer. You have to move your man



Moons of Jupiter by Romik.

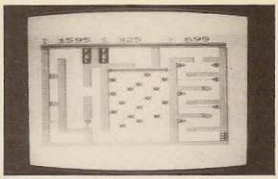
around a grid of traps defusing bombs within 60 seconds. Hazards are land mines and a roving boot which attempts to stomp you. As you cross the board the traps cave in behind you. Here you must use the Scroll keys to close up the ranks and enable you to move on.

Sumlock's version of Centipede is called Scorpion; instead of replicating mushrooms the screen is filled with cacti. A nice try at doing something new to a standard game, but it does not really make any difference. However, Scorpion is as good as most other Centipede games for Vic. Destroyer, also from Sumlock, features a ship depthcharging submarines and firing at bombers. Unfortunately, the sub's weapons are more like tadpoles than torpedoes and the game is rather slow and dull.

Like Destroyer, Sumlock's Gunfight is an intriguing idea which does not quite live up to expectations. Two mean old hombres blast away at each other in a rocky, cactus-studded desert. The graphics in this two-player game are rather dull, though, and it does not grip the player. Jumpin' Jack Sumlock's version of Frogger, is much better. The graphics are good, and the game is the equal of other similar ones for the Vic. There is a rather tedious tune, but you can always turn the sound down.

From Quicksilva comes The Trader Trilogy — 16K — which is an entertaining blend of adventure and game. You travel through the Meridien System bargaining with its various life-forms. Prepare to be humiliated by the Psions who "thrive on mental activity" and will ask you to do hard sums very quickly. Beware of the Deltans who would mug their grannies for a grain of that far-out inter-galactic drug Boosterspice. As well as the adventure side of Trader, there are various tasks to be performed such as piloting your ship into dock or finding your way round a Pac-Man style maze.

Quicksilva also produces, for the unexpanded



Software City's Defender on Tri.

Vic, Tornado and Skyhawk. Both are variants of Scramble, the former having the usual rugged terrain and the latter a deceptively peaceful-looking village.

The graphics are good, but sound is fairly limited. Of the two, Skyhawk is perhaps the more interesting as it involves landing to refuel, a trick which is rather difficult to master.

Romik's Moons of Jupiter is one of the few versions of Asteroids I have seen for the Vic. Graphics and sound are both good, and if you like Asteroids you will not be disappointed with it. Power Blaster, also from Romik, claims to be Venusians against Martians, but to me it looked more like a variation on Pac-Man. Your ship is in a maze and you have to blast the dots in front of you before you can move.

Anirog's version of Frogger is Frogman and again, it is pretty good, with graphics and sound up to the standard of any other version. Cavern Fighter is their Scramble-type game and in contrast of Frogrun is rather dull. It is slow and the graphics are crude; the so-called Fireballs are really purple jellyfish. Crawler is much better. This is Anirog's Centipede game and like all the others, is very fast and exciting with lively graphics.

There are not too many adventure games around for the Vic, but Commodore itself has produced a series of cartridges called the Scott Adams Adventure series. I confess that I do not see the attraction of adventure games in general, but I do not think I am being harsh when I say that the Scott Adams series is tedious. The commands and vocabulary are as limited as the original ideas. When you are stuck in the quicksand you just say swim and you are suddenly at the shore of a lake.

Most software houses have produced at least one game which deserves to be seen. The most impressive games for the Vic are the ones with the most original ideas Gridrunner, Mangrove, Gridtrap; such games show that not only does the Vic deserve to be considered as a games machine, but that home computer software does not necessarily have to imitate slavishly the fashion of the arcade. ■

Serpentine by Creative Software.

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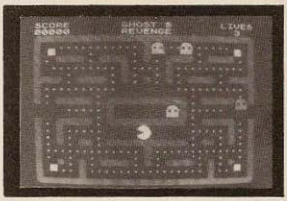
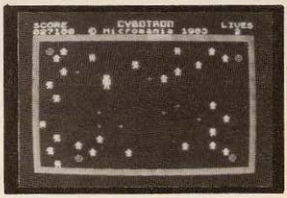


NEW

CYBOTRON

by Dominic Wood

New from Micromania, this has to be one of the best arcade type games available for the Spectrum. Blast away the attacking robots before they get you *Super-fast 100% machine code action *Excellent, smooth full colour graphics *Explosive sound effects *Four different types of robots *Deadly accurate bombs *With up to 50 robots on screen at a time, this game cannot be beaten. Top score, for Spectrum 16k or 48k. ONLY £5.95



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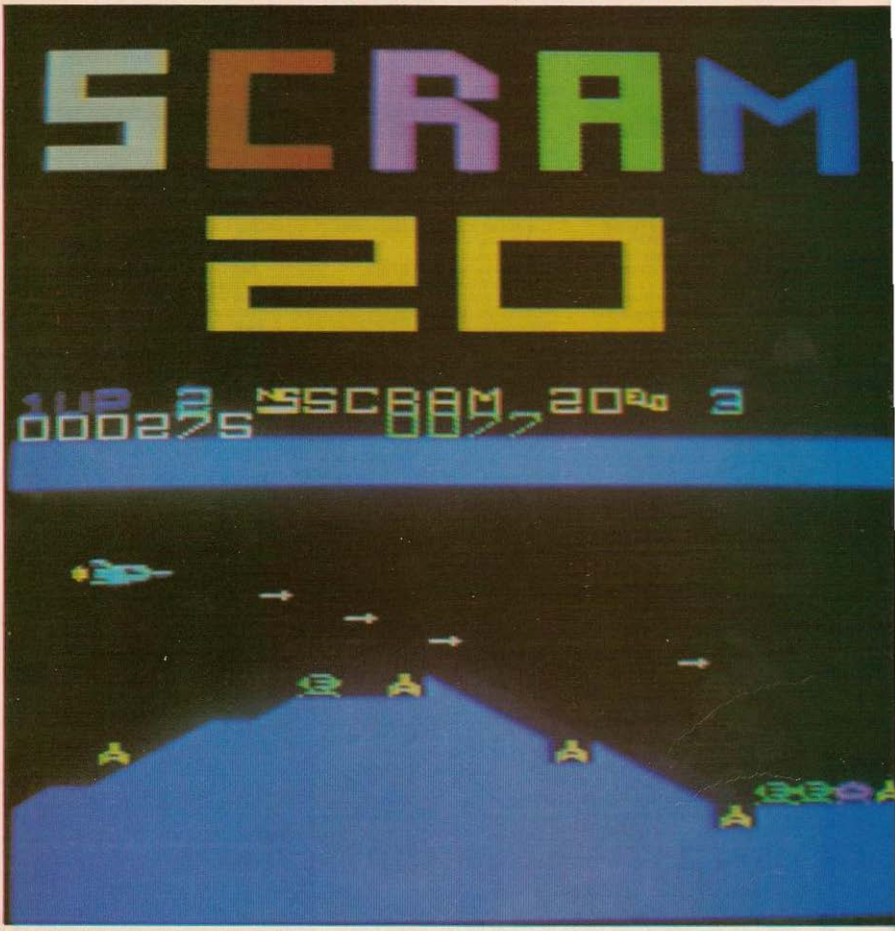

CORRIDORS

SCRAM-20 ALLOWS you to use a joystick or keys and opt for one or two-player games. You can fire four bullets or two bombs at a time. The game was written without an assembler. I used a modified version of listing 2, the Basic loader, but I would now strongly advise anybody who wishes to write machine-code programs to purchase an assembler of some sort — it makes life a great deal easier.

Even though Scram-20 runs on an unexpanded Vic-20 you will need a Vic with a monitor or a 3K expansion fitted to load it. If you have a Vic with greater expansion, then use these Pokes to reconfigure it to 3K for entering the program. Type, in direct mode:

POKE 641,0: POKE 642,4: POKE 643,0: POKE 644,30: POKE 648,30: SYS 64824.

To make your Vic think it is unexpanded for the purpose of running Scram-20:

POKE 641,0: POKE 642,16: POKE 643,0: POKE 644,30: POKE 648,30: SYS 64824.

The reason you need an expanded Vic to enter Scram-20 is that the object code occupies nearly all available memory in the unexpanded Vic. However if you have an unexpanded Vic with a machine-code monitor, you should be able to enter the code.

The game itself loads in two parts; first comes listing 1 and then the object code. Listing 1 prints Scram-20 in big letters, sets up the zero page for use, disables the stop key

VIC-20

Your mission is to destroy the enemy base. Your high-speed ship has 100 units of fuel which can only be replenished by hitting fuel dumps — each worth 25 units and a bonus 10 points. Beware of deadly anti-intruder missiles worth 50 or 150 points and the indestructible mines — Zoids and Superzoids. The purple Glamps are harmless but worth 95 points each, and keep an eye out for those UFOs. Remember — this machine-code game for the Vic-20 by Nalim Sharma is fast, very fast, and as you keep clearing the screens it keeps getting faster. So, take a deep breath, sit down in your armchair spaceship and set the controls for Scram-20.

OF FIRE

and the restore key, and sets up the kernal for loading the object code file.

So the first thing to do is to key in listing 1, check it carefully and then save it. Now you must enter the object code. This will require a lot of time and patience, but it is worth it. It is best to enter it in stages, that is 500 numbers per day or however many you feel you can manage. It is for this reason that you should use a different cassette to the one on which listing 1 resides. Once you have finished entering all the code then you should record it following listing 1 — be sure to get the correct position after listing 1 by verifying it. All locations are in decimal: numbers are in hex.

If you have a machine-code monitor then you can happily enter the code. However, you must save from location 4100 to 7679 inclusive with an end-of-tape marker. Also the file must have no name. On the other hand if you do not have a machine-code monitor you must do the following: Fit a RAM expansion pack on to your Vic. If it is not a 3K, reconfigure it as I have shown. Key in listing 2. This is your Basic loader, and do not forget to save it.

Now you can run it and you will be confronted with a menu:

1. Enter Code
2. Check Code
3. Load Code
4. Save Code

On pressing 1 you must give the starting and finishing address — in decimal — of the locations you wish to enter into. Once finished, you will return to the menu. On pressing 2 you must also give the start and finishing addresses and this will allow you to view each location on a separate line. While checking, you may press P — this will pause indefinitely. To turn the pause off, press P again. Also you may edit locations by pressing E. Then you must: enter the location to be edited, press Return; enter the hex number and then press return. To escape the edit mode and return to the checking mode, enter the location as zero and the hex number as zero.

Pressing 3 will allow you to load a file into the memory, so you can then enter more of the code or whatever. Anyway, the starting address for the load should always be 4100. Once finished loading, you will return to the menu.

Pressing 4 will save from locations 4100 to 7679 with an end-of-tape marker and no name. Once completed you will return to the menu.

Speed controls

Once you have finished keying in everything, you can try loading Scram-20. I cannot emphasise enough that you should check any code you have just entered, otherwise you are bound to have trouble. So if it does not work, it is more than likely that the errors will be in the code, and you will just have to check through painstakingly.

Location 4280 controls the speed of Scram-20 and is the one you may wish to alter, 43 hex is about right. Any higher and the game will get slower whereas lowering it will make the game faster.

One last thing: how to make a copy of Scram-20 once you have it on a cassette. First, make sure the Vic is unexpanded, second type

```
LOAD"SCRAM 20"
```

and this will load the first part. Third type

```
SAVE"SCRAM 20"
```

to save the first part on another cassette. Type

```
NEW
```

put the original cassette into the unit and type

```
LOAD "",1,1
```

Put the new cassette in and type

```
SAVE"",1,2
```

You should now have a copy. Do not forget to press Return. The controls are as follows: in the keyboard version press D to go up, F for thrust, V to go down, colon for bombs, semi-colon for lasers; in the joystick version push forward to go up, left for bombs, right for thrust, back for down.

There are five screens in Scram-20. In the first, which is blue, you must fly over a mountain range avoiding the rockets which will fire upwards in an attempt to destroy you. The Glamps hang glumly around the fuel dumps.

Screen two is green and closes in a little. The surfaces become a rocky terrain. You now face the UFOs which bounce up and down and generally get in your way. There are also fuel dumps and Glamps.

On the third screen — purple — the surface changes and you must now do battle with rockets, as in sheet 1, and Zoids which travel from right to left. Remember that Zoids are invulnerable except to rockets. Clumps of Glamps and fuel dumps still proliferate at this level.

Deadly Superzoids

The fourth screen is cyan, or greenish-blue and becomes very narrow and you must avoid the deadly Superzoids. These are identical to Zoids except that they travel twice as fast. At this level it is very easy to crash into the walls. Also present on the surface are fuel dumps, Glamps and harmless rockets.

Screen five is red and requires precision flying, bombing and shooting — no joke. You must fly through what will seem like an endless zig-zag. The fun part is that in doing this you must also do battle with rockets as in sheet one. Also there is the occasional fuel dump to bomb or strafe.

Now comes the central target of your mission — the Base. Once you have completed screen five, you will see the enemy base made up of green power cells. On bombing or shooting the base, you will witness a special effect. Once this is over, you will get 5,000 points and an extra life and you have to start again; the game just keeps on going. When you complete one sheet and so on to the next, the game speeds up and just keeps on becoming faster each time you complete a sheet.

By pressing the pound sign you may halt the game at any time. Fl will restart the game for you. The score on the top left is for player 1 and on the top right is the score for player 2. The fuel is shown — top centre — in green.

If you are unable to key in Scram-20 but would like a cassette of it, then send £3 — including postage and packing — to: Scram-20 Offer, 35 Kitchener Road, Walthamstow, London, E17 4LJ.

(continued on page 69)

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(continued from page 67)

```
2 REM FOR "▒" READ INVERSE POUND SIGN
3 REM CTRL + KEY 3
4 PRINT"▒":POKE36879,8:PRINTCHR$(8)
5 PRINT"▒"
6 PRINT"▒"
7 PRINT"▒"
8 PRINT"▒"
9 PRINT"▒"
10 PRINT"▒"
11 PRINT"▒"
12 PRINT"▒"
13 PRINT"▒"
14 PRINT"▒"
20 PRINT"▒    ▒COPYRIGHT 1983"
30 PRINT"▒    ▒NALIN SHARMA▒"
31 DATA1,5,26,37,48,23,23,23,23,23,23,23,23,23,25,25,24,24,24,24,24,24,24,24,24
,32,25,25
32 DATA25,25,25,25,25,25,25,25,32,23,23,23,23,25,25,24,24,24,24,32,23,25,25,25,
23,25,25
33 DATA25,23,25,25,25,23,25,25,25,23,25,25,25,24,24,24,24,24,32,0,1,1
34 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0
35 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
36 DATA162,0,232,189,112,23,149,0,224,143,208,246
37 DATA169,194,141,20,3,169,3,141,30,145
40 DATA169,1,162,1,160,3,32,186,255,169,0,32,189,255,169,0,162,4,160,16,76,1,16
50 POKE4097,32:POKE4096,213:POKE4099,255
60 FORX=0TO180:READA:POKEX+6000,A:NEXT
70 SYS6144
```

Loader program.

```
5 REM FOR "▒" READ INVERSE POUND SIGN
6 REM CTRL + KEY 3
9 POKE56,15:POKE52,15:POKE55,250:POKE51,250:CLR
10 PRINT"▒    MACHINE CODE AID   "
20 PRINT"     ▒1▒=ENTER CODE"
25 PRINT"▒    ▒2▒=CHECK CODE "
27 PRINT"▒    ▒3▒=LOAD CODE "
30 PRINT"▒    ▒4▒=SAVE CODE "
40 GETA$:IFA$=""THEN40
43 V=VAL(A$)
47 IFV>2THEN50
48 INPUT"START,FINISH";UU,VV
50 IFV=3THENGOSUB 500:GOTO10
51 IFV=4THENGOSUB 600:GOTO10
52 FORX=UUTOVV
54 IFV=2THENDT=PEEK(X):D=DT:GOSUB110:PRINTX,H$:GOTO61
55 PRINTX;:INPUTH$
56 GOSUB320
57 POKEX,DT
61 FORDE=1TO50:NEXT
62 GETO$
63 IFO$="F"THENGOSUB450
64 IFO$="H"THENGOSUB460
65 IFO$="D"THENGOSUB470
66 IFO$="E"THENGOSUB480
70 NEXTX:GOTO10
110 REM*** DEC-HEX ***
122 DD=D:H$=""
125 IFD=0THENRETURN
127 IFD>65535ORD<0THENRETURN
130 FORI=3TO0STEP-1
140 Z=D/(16↑I)
150 IFZ<1THENH(I)=0:GOTO185
160 H(I)=INT(Z):D=D-(H(I)*(16↑I))
185 IFH(I)>9THEN195
190 H$=H$+CHR$(H(I)+48)
193 GOTO200
195 H$=H$+CHR$(H(I)+55)
200 NEXTI
220 FORDE=1TO50:NEXT:RETURN
320 REM*** HEX-DEC ***
322 DT=0
325 IFH$="Z"THENPRINT"▒          ▒DONE":RETURN
327 FORDE=1TO50:NEXT
330 HL=LEN(H$)
335 IFHL>4THEN322
340 FORI=HLTO1STEP-1
350 A=ASC(MID$(H$,I,1))
360 IFA>60THEN390
370 A=A-48
380 GOTO400
390 A=A-55
400 DT=DT+(A*(16↑(HL-I)))
410 NEXTI
430 RETURN
450 GETA$:IFA$<>"P"THEN450
451 RETURN
460 PRINT:INPUT"HEX ";H$:GOSUB320:PRINT"▒"TAB(11);DT
461 IFH$="0"THENRETURN
462 GOTO460
470 PRINT:INPUT"DEC ";DZ:D=DZ:GOSUB110:PRINT"▒"TAB(12);H$
471 IFDZ=0THENRETURN
472 GOTO470
480 PRINT"          ▒EDIT":PRINT:INPUT"LOC ";LO
481 INPUT"HEX ";H$
482 GOSUB320
483 PRINT"▒"LO;" = ▒"H$;"  = ▒"DT
484 IFLO=0THENRETURN
485 POKELO,DT:GOTO480
500 POKE780,1:POKE781,1:POKE782,3
501 SYS65466:POKE780,0:SYS65469
502 PRINT:INPUT"▒START";SR:POKE782,INT(SR/256)
503 POKE781,SR-(PEEK(782)*256)
504 POKE780,0:PRINT"          ▒LOADING▒":SYS65493:RETURN
600 POKE780,1:POKE781,1:POKE782,255:SYS65466
601 POKE780,0:SYS65469:POKE780,0:POKE781,255
602 POKE782,29:POKE0,4:POKE1,16
603 PRINT"          ▒SAVING▒":SYS65496:RETURN
```

Scram-20 main listing.

```
4100 A9 01 A2 01 A0 03 20 BA FF A9
4110 00 20 BD FF A9 00 A2 00 A0 00
4120 20 D5 FF EA EA EA EA A9 FF 8D
4130 05 90 A9 93 20 D2 FF A2 FF E8
4140 E0 03 F0 0F B5 8A 1D 85 F0 F5
4150 D5 67 10 05 A2 00 20 7C 1B A2
4160 FF E8 E0 03 F0 0F B5 8A D5 6A
4170 F0 F5 D5 6A 10 05 A2 03 20 7C
4180 1B A2 00 BD D0 1D 9D 06 1E A9
4190 07 9D 06 96 E8 E0 0A D0 F0 A2
4200 04 BD D9 1D 9D CE 1E A9 03 9D
4210 CE 96 CA E0 00 D0 F0 A0 00 A2
4220 F0 35 8A 4A 4A 4A 4A 99 FA 1E
4230 A9 0F 35 8A 99 FB 1E A9 01 99
4240 FA 96 C8 99 FA 96 C8 E8 E0 07
4250 D0 DF A2 FF E8 A9 00 95 67 E0
4260 05 D0 F7 A9 03 85 65 85 66 A9
4270 01 85 4B 85 4C 85 4D 85 4E A9
4280 43 85 4F 85 50 A2 00 BD F4 1D
4290 9D 68 1F A9 01 9D 68 97 E8 E0
4300 05 D0 F0 A2 FF 20 E9 1B A9 20
4310 9D 68 1F E8 E0 05 D0 F6 A2 FF
4320 20 89 1B A5 C5 C9 40 F0 D4 C9
4330 27 F0 07 C9 2F F0 0C 4C BD 10
4340 A9 01 4C FB 10 A9 02 85 63 A9
4350 55 85 64 20 B5 1B 20 99 1B 85
4360 73 85 70 A9 01 85 00 A9 FF 85
4370 4A A9 01 85 6F 20 A6 1B A2 74
4380 95 00 E8 E0 84 D0 F9 A9 DC 85
4390 71 A9 1E 85 72 A9 0F 8D 0E 90
4400 A5 65 8D 04 1E A5 66 8D 11 1E
4410 A9 03 8D 04 96 8D 11 96 85 51
4420 A5 64 29 03 85 8D A0 01 C4 63
4430 F0 1D A6 8D A9 00 D5 64 D0 26
4440 A5 64 49 FF 85 64 29 03 85 8D
4450 A6 8D A9 00 D5 64 D0 14 4C 29
4460 10 A9 55 85 64 A9 01 85 8D A9
4470 00 C5 65 D0 03 4C 29 10 A2 00
4480 BD DE 1D 9D CF 1E A9 05 9D CF
4490 96 E0 03 F0 04 E8 4C 80 11 A2
4500 00 BD E2 1D 9D F9 1E A9 05 9D
4510 F9 96 E0 06 F0 04 E8 4C 95 11
4520 E8 A5 8D 99 F9 1E A9 01 9D F9
4530 96 A9 00 85 52 A2 05 20 89 1B
4540 E6 52 A5 52 8D 0C 90 C9 0A D0
4550 F0 20 B5 1B 20 B2 1A A2 00 A9
4560 19 9D E4 1F A9 07 9D E4 97 E0
4570 15 F0 04 E8 4C CF 11 A5 70 C9
4580 00 D0 09 A5 6F C9 00 D0 03 4C
4590 C9 10 A4 73 A9 20 91 71 C8 91
4600 71 C8 91 71 A0 00 A5 75 C9 00
4610 F0 04 A9 20 91 74 A5 77 C9 00
4620 F0 04 A9 20 91 76 20 C5 1B A2
4630 FF E8 E0 F0 21 E8 B5 55 85 84
4640 E8 B5 55 C9 00 D0 04 E8 4C 17
4650 12 85 85 E8 B4 55 C0 FF D0 01
4660 C8 A9 20 91 84 4C 17 12 A0 00
4670 A5 8D A8 C9 01 F0 02 A0 13 A5
4680 8D 99 00 1E A9 20 99 01 1E A9
4690 25 99 02 1E 38 A9 07 F5 4A 99
4700 00 96 99 01 96 99 02 96 20 68
4710 1B A5 C5 C9 40 D0 03 4C 1F 13
4720 C9 06 D0 03 20 F8 1A EA EA EA
4730 EA C9 16 D0 2D A2 01 B5 78 C9
4740 00 F0 EA 0A F0 17 E8 E8 E8 E0
4750 4C 81 12 CA A5 71 95 78 E8 A5
4760 72 95 78 E8 A4 73 C8 C8 94 78
4770 A9 01 C5 6E D0 01 60 4C 82 13
4780 C9 2D D0 2E A2 01 B5 74 C9 00
4790 F0 09 E8 03 F0 E6 E8 E8 4C B2
4800 12 CA A5 71 18 E6 73 65 73 95
4810 74 C6 73 A5 72 69 00 E8 95 74
4820 A9 01 C5 6E D0 01 60 4C 82 13
4830 C9 12 D0 1C A5 72 C9 1E D0 06
4840 A5 71 C9 2C F0 0D 38 A5 71 E9
4850 16 85 71 A5 72 E9 00 85 72 4C
4860 82 13 C9 1B D0 0E 18 A5 71 69
4870 16 85 71 A5 72 69 00 85 72 EA
4880 C9 2A D0 08 A9 0F C5 73 F0 02
4890 E6 73 4C 82 13 A9 01 85 6E A5
4900 00 8D 13 91 A9 7F 8D 22 91 AD
4910 11 91 05 0E A0 20 91 85 8F A5
4920 8E 29 20 C9 00 D0 03 20 7F 12
4930 A5 8E 29 10 C9 00 D0 03 20 B0
4940 12 A2 00 85 6E A5 8E 29 04 C9
4950 00 D0 03 4C E2 12 A5 8E 29 08
4960 C9 00 D0 03 4C 02 13 A5 8F 29
4970 80 C9 00 D0 03 4C 14 13 A5 8E
4980 29 30 C9 30 D0 08 A4 73 C0 00
4990 F0 02 C6 73 A4 73 C0 B1 71 C9
5000 20 F0 03 4C C9 18 C8 B1 71 C9
5010 20 F0 03 4C C9 18 20 B2 1A A9
5020 0B 20 54 1A C9 FF F0 09 A9 0C
5030 20 54 1A C9 FF D0 03 4C C9 18
5040 A5 73 69 85 8D 0D 90 E6 62 A6
5050 8D A9 06 D5 4A D0 03 4C 23 15
5060 A2 FF E0 0B D0 03 4C 23 15 E8
5070 A9 00 D5 56 D0 05 E8 E8 4C C6
5080 13 B5 55 85 86 E8 B5 55 85 87
5090 E8 B4 55 C0 FF D0 15 C8 38 B5
5100 53 E9 16 85 86 95 53 B5 54 E9
5110 00 85 87 95 54 4C 46 14 88 C0
5120 FF D0 07 A9 00 95 54 4C C6 13
5130 94 55 0A 48 EA EA EA EA EA A6
5140 8D A9 04 D5 4A D0 03 4C E6 14
5150 A9 02 D5 4A D0 03 4C 89 14 68
5160 AA A5 73 18 69 02 D5 55 D0 14
5170 A0 FF 94 55 C8 18 75 53 95 53
5180 85 86 A9 00 75 54 95 54 85 87
5190 EA EA EA EA EA EA EA EA EA EA
5200 EA EA EA EA EA EA EA EA EA 20
5210 AC 1D C9 20 F0 0A C9 0B D0 03
5220 4C C9 18 4C C6 13 B5 55 C9 FF
5230 D0 04 A9 DC 65 62 8D 0B 90 A9
5240 11 91 86 18 A9 78 65 87 85 87
5250 A9 07 91 86 4C C6 13 68 AA A5
5260 62 C9 05 10 14 C9 00 F0 10 38
5270 B5 53 E9 16 95 53 B5 54 E9 00
5280 95 54 4C B2 14 18 B5 53 69 16
5290 95 53 B5 54 69 00 95 54 B5 53
5300 85 86 B5 54 85 87 20 AC 1D C9
5310 20 F0 0A C9 0B D0 03 4C C9 18
5320 4C C6 13 A9 12 91 86 18 A9 78
5330 65 87 85 87 A9 02 91 86 A5 62
5340 0A 0A 69 C8 8D 0B 90 4C C6 13
5350 68 AA D6 55 B4 55 C0 FF D0 07
5360 A9 00 95 54 4C C6 13 94 55 18
5370 AC 1D C9 20 F0 0A C9 0B D0 03
5380 4C C9 18 4C C6 13 A9 13 91 86
5390 18 A9 78 65 87 85 87 A9 01 91
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5680 04 91 86 4C 33 18 A9 0F 91 84
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5840 D0 04 A9 00 85 4A A9 04 C5 4A
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5860 05 85 53 20 09 1B A6 62 E0 04
5870 D0 1A A9 13 91 71 A9 FF 85 62
5880 18 A5 71 85 84 A9 78 65 72 85
5890 85 A9 01 91 84 4C 33 18 20 09
5900 1B A6 62 E0 02 30 03 4C 27 16
5910 E0 01 D0 03 4C 17 16 4C 33 18
5920 C9 04 F0 03 4C 8E 17 A5 4A C9
5930 00 D0 07 A9 0B 85 51 4C 3C 17
5940 C9 06 D0 04 A9 00 85 4A A5 4A
5950 C9 03 30 05 C6 51 4C 49 17 E6
5960 51 A9 04 85 53 20 09 1B A6 62
5970 E0 05 D0 0F A2 00 86 62 A5 71
5980 85 84 A5 72 85 85 20 D8 1A 20
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6000 16 C9 04 F0 F9 C9 03 D0 03 4C
6010 2B 16 C9 01 F0 03 4C 33 18 A9
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6130 20 09 1B A5 4A C9 0A 10 03 4C
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6150 BD EF 1D AA A9 16 91 84 A9 05
6160 91 86 38 A5 84 E9 16 85 84 85
6170 86 A5 85 E9 00 85 85 18 A9 05
6180 69 78 85 87 CA E0 00 F0 03 4C
6190 0A 18 EA EA EA A4 73 A9 2A 91
6200 71 20 C5 1B 20 70 19 A4 8D B6
6210 4E 20 89 1B A0 00 A2 67 A5 8D
6220 C9 01 F0 04 A0 10 A2 6A A9 F8
6230 35 00 4A 4A 4A 4A 99 16 1E A9
6240 01 99 16 96 C8 A9 0F 35 00 99
6250 16 1E A9 01 99 16 96 C8 05 F0
6260 09 C0 15 F0 05 E8 C8 4C 54 18
6270 A0 09 F8 38 A5 70 E9 01 85 70
6280 A5 6F E9 00 85 6F D8 A2 00 A9
6290 F0 35 6F 4A 4A 4A 4A 99 16 1E
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6310 99 16 1E A9 05 99 16 96 E0 01
6320 F0 05 C8 E8 4C 91 18 A9 00 8D
6330 0C 90 8D 0B 90 8D 0A 90 4C E1
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6350 A9 15 91 71 C8 91 71 C8 91 71
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6390 A6 8D D6 64 A5 64 49 FF 85 64
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6440 A5 54 C9 00 D0 F3 4C 01 11 20
6450 A6 1B A6 8D A9 01 95 4A 95 4C
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6480 67 95 67 D8 A9 FF 85 52 A0 9A
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6500 0F 90 8D 0C 90 C9 08 D0 ED 4C
6510 01 11 A2 FF E0 0B D0 01 60 E8
6520 B5 79 C9 00 D0 05 E8 E8 4C 72
6530 19 F6 7A B4 7A C0 16 D0 09 A9
6540 00 95 79 E8 E8 4C 72 19 B5 78
6550 E8 85 84 B5 78 E8 85 85 B1 84
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6580 01 91 84 B5 78 69 ED 8D 0C 90
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6720 95 66 CA A9 00 75 66 95 66 CA
6730 A9 00 75 66 95 66 D8 68 AA 60
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6750 E8 48 B5 78 C9 00 D0 B5 55 85
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6770 00 C5 87 D0 04 68 4C 5A 1A 68
6780 D1 86 D0 DA C9 0B F0 23 C9 0C
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6840 18 A5 71 85 86 A5 72 69 78 85
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6870 71 60 A2 FF E0 0B D0 01 60 E8
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6890 A5 85 95 56 A9 15 95 57 60 E8
6900 E8 4C DA 1A A9 00 8D 0E 90 A5
6910 C5 C9 27 D0 FA A9 0F 8D 0E 90
6920 60 A9 2C 85 84 85 86 A9 1E 85
6930 85 A9 96 85 87 A0 15 A6 53 E0
6940 00 F0 1B 20 6A 1B 18 A5 84 69
6950 16 85 84 85 86 A5 85 69 00 85
6960 85 18 69 78 85 87 CA 4C 1B 1B
6970 A9 E4 85 84 85 86 A9 1F 85 85
6980 A9 97 85 87 A6 51 E0 00 F0 1B
6990 20 6A 1B 38 A5 84 E9 16 85 84
7000 85 86 A5 85 E9 00 85 85 18 69
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7080 8D 0D 90 8D 0C 90 8D 0B 90 8D
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7100 C6 52 A9 00 C5 52 D0 F5 60 A2
7110 FF E0 0B D0 01 60 E8 B5 79 C9
7120 00 D0 05 E8 E8 4C C7 1B B5 78
7130 85 84 E8 B5 78 85 85 E8 B4 78
7140 A9 20 91 84 4C C7 1B A9 FF 85
7150 52 C6 52 A5 52 8D 0D 90 EA EA
7160 EA EA EA C9 78 D0 F0 60 42 42
7170 42 42 42 42 42 7E 08 18 28 08
7180 08 08 08 3E 7E 42 02 02 7E 40
7190 42 7E 7E 42 02 02 3E 02 42 7E
7200 08 18 28 48 7E 08 08 08 7E 42
7210 40 40 7E 02 42 7E 7E 42 40 40
7220 7E 42 42 7E 7E 42 02 04 08 10
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7240 7E 42 42 42 7E 02 42 7E 00 00
7250 0A 14 0A 14 0A 00 E8 38 1F 7E
7260 7E 7F 1F FF 00 00 E0 70 3F F0
7270 E0 00 00 00 00 04 7E 04 00 00
7280 3C 18 3C 3C 3C 3C 18 00 3C 42
7290 DF C3 5E 24 7E 81 18 7E E7 C3
7300 FF 7E 42 C3 18 18 18 3C 66 7E
7310 66 42 18 7E A5 B5 A5 D5 7E 18
7320 08 38 40 D5 EA 40 30 08 07 0C
7330 18 FC FC 18 0C 07 24 00 99 24
7340 24 99 00 24 3C 42 A5 99 99 A5
7350 42 3C 01 03 07 0F 1F 3F 7F FF
7360 80 C0 E0 F0 F8 FC FE FF FF FF
7370 FF FF FF FF FF FF 3C 42 42 42
7380 7E 42 42 42 7C 42 42 5C 42 42
7390 42 7C 7E 42 40 40 40 40 42 7E
7400 78 44 42 42 42 42 44 78 7E 42
7410 40 40 7C 40 40 42 7E 42 40 42
7420 5E 42 42 7E 00 00 00 00 00 00
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7460 42 42 42 42 7E 42 42 42 7E 40
7470 40 40 7C 42 42 42 7C 42 42 42
7480 42 42 42 42 42 42 24 18 42 42
7490 42 42 42 42 42 3C 42 42 42 42
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7510 04 00 9F D9 B8 9F 01 01 FF FF
7520 E0 90 D7 95 F5 1D 07 00 A9 2C
7530 85 84 85 86 A9 1E 85 85 A9 96
7540 85 87 A2 00 A0 00 C0 B1 84 88
7550 91 84 C8 B1 86 88 91 86 C8 C0
7560 15 D0 EF A9 20 91 84 E8 E0 15
7570 D0 01 60 A5 84 18 69 16 85 84
7580 85 86 A5 85 69 00 85 85 18 69
7590 78 85 87 4C 78 1D B1 86 C9 20
7600 D0 01 60 C9 0B D0 01 60 C9 0C
7610 D0 03 A9 0B 60 A9 15 91 86 20
7620 EB 1B A9 20 91 86 A9 00 95 54
7630 60 EA 2B 05 1C 26 1A 24 20 02
7640 00 2C 21 22 1F 21 25 23 1A 29
7650 25 23 1A 29 1E 26 20 1F 1A 24
7660 1E 20 00 27 1E 26 28 25 26 1E
7670 1A 1D 29 07 08 09 0A 09 08 2F
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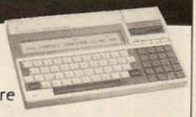

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KNOT IN 3D Brand new mind-boggler from the author of 'Escape' and 'Tunnel'. Absolutely brilliant. Untangle yourself - or get knotted. Avoid collisions: worry about the chasers as you roam through an apparently empty 3D space. But is it? Are you? (New Generation) £5.95

BLACK CRYSTAL *"An excellent graphics adventure" (S. User)*. The massive 180K of program, 'loads' from 2 cassettes in 6 chapters. You must solve each of the 6 stages to defeat the Lords of Chaos. Real-time monster battles, 16 command keys. Instruction manual. (Carnell) £7.50

THE HOBBIT *"Takes first place for quality and value for money" (S. User) "A marvellous game...should set the standard" (ZX Comp)*. Free 285 p illustrated book contains clues to help you. 30 beautiful full-screen pictures; 500 word vocabulary, 16 page instruction manual: it took 4 people 18 months to write! (Melbourne House) £14.95

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ANY SPECTRUM

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ARCADIA *"Stunning graphics have no equal" (S. User). "In the top 3 arcade games" (ZX Comp)*. The most aliens you've ever met. Move in 4 directions to avoid them. Choose your own keys. Incredible. (Imagine) £5.50

INVASION FORCE Stop the invasion by blowing away the bomb ship by shooting through the force field. Suicidal game option. (Artic) £4.95

MINED OUT *"It is impossible to fault...maddeningly adictive" (PCN)*. Just crawl across a mine field to rescue Bill. Bonuses for speed and for damsels. Watch out for walking mines. Action replay drives you crazy. (Quicksilva) £4.95

COSMIC GUERILLA Yet another mind-bending variation on Invaders. 4 game options: 6 skill levels for each gives you 24 games in 1. Will make your wrist ache. (Crystal) £5.50

AIR TRAFFIC CONTROL If you've outgrown your flight simulator, get in charge at Heathrow. Land your planes safely. Watch out for rogues. 6 skill levels, plus demo. (Hewson) £5.95

WINGED AVENGER *"Hard to beat" (CVG). "One of the best Sinclair games so far" (PCW)*. Very fast 'PHOENIX', 7 play levels, 3 attack waves, laser shield: mothership with smart bombs. A best-seller. (Work Force) £4.50

3D TUNNEL *"Superb graphics and game presentation" (CVG)*. Fly down the winding 3D tunnel, shooting bats, spiders, frogs and rats. Demo mode: 3 speeds: training program for each phase. (New Generation) £5.95

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FAUST'S FOLLY The first adventure we've seen that's worth playing in 16K. It's great and it's graphic! Loads in 2 parts: clear instructions: then a smashing adventure with directions, inventory, look, score, save. (Abbex) £5.95

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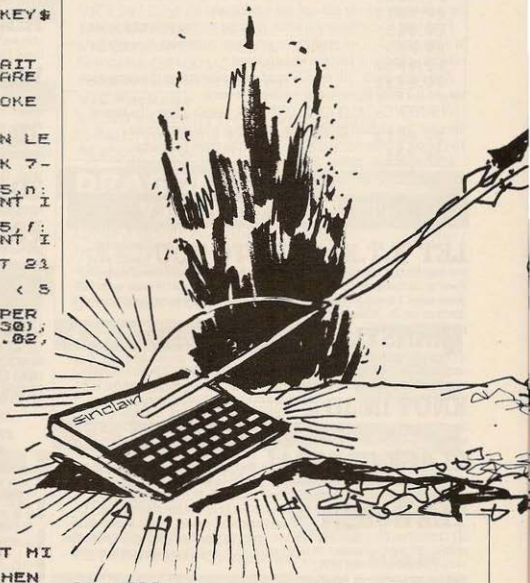



```
 10 FOR n=144 TO 148 : FOR f=0
TO 7
 20 READ a: POKE USR (CHR$ n)+f
,a: NEXT f: NEXT n
 30 DATA 0,0,0,60,126,255,255,0
 40 DATA 126,255,189,189,255,25
5,231,231
 50 DATA 0,28,36,66,66,165,90,6
0
 60 DATA 24,60,126,60,255,255,1
02,102
 70 DATA 156,92,40,31,28,36,66
 80 PRINT INK 0;AT 10,4;"DO YO
U WANT TO SEE"'"  THE INSTRUCTIO
NS?(Y/N)"
 82 PAUSE 1: PAUSE 0: IF INKEY$
="Y" THEN GO SUB 1000
 83 INPUT "LEVEL?(1-9)";d
 84 IF d<1 THEN GO TO 83
 85 PRINT AT 14,3;"PLEASE WAIT
A MOMENT"'" WHILE THE MINES ARE
SET UP"
 100 FOR n=33940 TO 34510: POKE
n,0: NEXT n
 115 LET sc=0
 120 LET co=7-d: IF co<4 THEN LE
T co=6
 125 BORDER co: PAPER co: INK 7-
co: CLS
 130 FOR n=0 TO 31: BEEP .005,n:
PRINT INK 2;AT 1,n;"Q": PRINT I
NK 2;AT 21,n;"Q": NEXT n
 140 FOR f=1 TO 21: BEEP .005,f:
PRINT INK 2;AT f,0;"Q": PRINT I
NK 2;AT f,31;"Q": NEXT f
 150 PRINT PAPER co; INK 1;AT 21
,14;" ";AT 1,15;"▟ "
 160 LET a$="                    < S
AFE AREA  >                    "
 170 FOR n=1 TO 30: PRINT PAPER
co; INK n/5;AT 20,1;a$(n TO 30);
AT 2,n;a$(16 TO 46-n): BEEP .02,
11-n/3: BEEP .02,n/3: NEXT n
 175 LET po=555: LET co=7-d
 187 REM **SET UP MINES**
 190 FOR n=1 TO 20+(d*2):
LET a=INT (509*RND)+1: POKE
(34000+a),21: NEXT n
 192 LET ma=132: LET q=0:
LET d=d+1: LET x=21: LET
y=15
 193 IF d>4 THEN GO SUB 290
 195 LET m=0: IF co<3 THEN
LET co=6
 200 PRINT INK 1; PAPER 6;
BRIGHT 1;AT x,y;"▚"
 205 IF INT (RND*4)=2 THEN
LET m=m+1
 207 REM **CHECK FOR ADJACENT MI
NES**
 208 IF PEEK (34000+po)=21 THEN
GO TO 350
 210 IF PEEK (33999+po)=21 THEN
LET m=m+1
 215 IF PEEK (34001+po)=21 THEN
LET m=m+1
 220 IF PEEK (34030+po)=21 THEN
LET m=m+1
 225 IF PEEK (33970+po)=21 THEN
LET m=m+1
 226 PRINT AT x,y; PAPER 6; BRIG
HT 1;""
 230 LET k$=INKEY$
 231 IF CODE k$<53 OR CODE k$>56
THEN GO TO 235
 232 IF k$<>"" THEN LET ma=ma-1
 233 IF x=2 AND y=16 AND k$="7"
THEN GO TO 600
 234 GO SUB (VAL k$*10)+200
 235 LET q=q+1
 237 POKE 35999+q,VAL k$
 238 PRINT PAPER m; INK 7;AT 0,1
0;m;" ADJACENT MINE ": IF m<>1 T
HEN PRINT PAPER m; INK 7;AT 0,25
;"S"
 240 IF d>4 THEN GO SUB 310
 245 GO TO 195
 247 REM ###MOVEMENT###
 250 LET y=y-1: IF y<1 OR x=21 A
ND y<14 THEN GO TO 1500
 255 LET po=po-1: RETURN
 260 LET x=x+1: IF x>20 THEN GO
TO 1500
 265 LET po=po+30: RETURN
 270 LET x=x-1: IF x<2 THEN GO T
O 1500
 275 LET po=po-30: RETURN
 280 LET y=y+1: IF y>30 OR x=21
AND y>16 THEN GO TO 1500
 285 LET po=po+1: RETURN
 290 LET bx=INT (RND*17)+3: LET
by=INT (RND*30)+1
 300 POKE 35000,0: PRINT AT bx,b
y;"▚": RETURN
 310 IF PEEK 35000=1 THEN RETURN

 315 IF x=bx AND y=by THEN GO TO
330
 320 RETURN
 330 BEEP .5,20: POKE 35000,1: R
ETURN
 350 LET j=(7.95*y)+4: LET k=175
-(7.95*x+4)
 355 BEEP 1,-30: BEEP 1,-35
 360 FOR n=1 TO 20: PLOT j,k: DR
AW INK 2;10*SIN n,10*COS n: NEXT
n
 361 FOR n=0 TO 6: PRINT INK n;A
T 10,12;"BLAST": BEEP .25,-20-n
: NEXT n: PAUSE 1: PAUSE 50
 362 GO SUB 650
 365 PAUSE 1: PAUSE 150: GO SUB
400
```

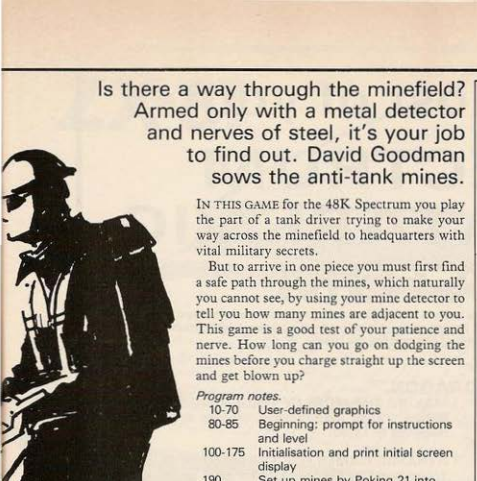
Is there a way through the minefield? Armed only with a metal detector and nerves of steel, it's your job to find out. David Goodman sows the anti-tank mines.

IN THIS GAME for the 48K Spectrum you play the part of a tank driver trying to make your way across the minefield to headquarters with vital military secrets.

But to arrive in one piece you must first find a safe path through the mines, which naturally you cannot see, by using your mine detector to tell you how many mines are adjacent to you. This game is a good test of your patience and nerve. How long can you go on dodging the mines before you charge straight up the screen and get blown up?

Program notes.

10-70	User-defined graphics
80-85	Beginning: prompt for instructions and level
100-175	Initialisation and print initial screen display
190	Set up mines by Poking 21 into random positions
192-200	Variable and Print tank
208-225	Mine detection
250-285	Movement and check for hitting fence
290-330	Stranded soldier
350-362	Explosion routine
400-470	Action replay
500-615	Success, tune and routine
650-680	Death march
1000-1110	Instruction
1500-1590	Electric fence routine




```
 370 PRINT INK 0;AT 10,4;"ANOTHE
R GO?(y/n)": PAUSE 1: PAUSE 0
 375 IF INKEY$="n" THEN STOP
 380 RUN 83
 390 REM ©©© ACTION REPLAY ©©©
 400 CLS : FOR n=0 TO 31: PRINT
INK 2;AT 1,n;"©": PRINT INK 2;AT
 21,n;"©": NEXT n
 410 FOR f=1 TO 21: PRINT INK 2;
AT f,0;"©": PRINT INK 2;AT f,31;
"©": NEXT f
 415 LET g=0
 420 FOR x=3 TO 19: FOR y=1 TO 3
0
 430 LET g=g+1: IF PEEK (34000+g
)=21 THEN PRINT INK 0;AT x,y;"▲"
 435 NEXT y: NEXT x
 440 PRINT AT 0,10;"[redacted]
";AT 0,0;"Score:";sc;AT 1,15;"
[redacted] ";AT 21,14;"  "
 442 IF d>4 THEN PRINT AT bx,by;
"*"
 445 LET x=21: LET y=15
 450 FOR a=0 TO q-1: LET r=PEEK
(36000+a)
 452 IF r=6 AND x<20 THEN LET x=
x+1
 453 IF r=7 AND x>2 THEN LET x=x
-1
 454 IF r=8 AND y<30 THEN LET y=
y+1
 455 IF r=5 AND y>1 THEN LET y=y
-1
 457 PRINT INK 1; BRIGHT 1; PAPE
R 6;AT x,y;"▲"
 460 PAUSE 10: PRINT AT x,y; PAP
ER 6; BRIGHT 1;" "
 465 NEXT a
 470 GO SUB 650: RETURN
 500 FOR f=0 TO 10 STEP 6: RESTO
RE 510: FOR n=0 TO 7: READ a,b
 505 BEEP a*2,b+f: NEXT n: NEXT
f
 510 DATA .1,0,.05,0,.05,0,.05,5
 520 DATA .06,0,.06,6,.25,9,.25,
5
 530 RETURN
 600 LET d=d+1: LET sc=sc+ma: GO
SUB 500: PRINT AT 0,1;"score:";
sc
 610 IF PEEK 35000=1 THEN LET sc
=sc+50: PAUSE 1: PAUSE 150: GO T
O 120
 615 PAUSE 1: PAUSE 150: GO TO 1
20
 650 RESTORE 670: FOR n=1 TO 11:
READ a,b
 660 BEEP a,b: NEXT n: RETURN
 670 DATA .5,-3,.55,-3,.2,-3,.65
,-3
 680 DATA .5,0,.25,-1,.5,-1,.25,
-3,.5,-3,.25,-4,.75,-3
1000 INK 1: BORDER 6: PAPER 6: C
LS
1005 PRINT AT 1,4;"©©©©©©©©©©©©©©
©©©©©©©"
1010 PRINT AT 2,4;"©[redacted]
[redacted]©"
1020 PRINT AT 3,4;"©[redacted]
[redacted]©"
1030 PRINT AT 4,4;"©[redacted]
[redacted]©"
1040 PRINT AT 5,4;"©[redacted]
[redacted]©"
1050 PRINT AT 6,4;"©[redacted]
[redacted]©"
1060 PRINT AT 7,2;"©©©";AT 7,23;
"©©©"
1080 PRINT AT 8,2;"©[redacted]
[redacted]©"
1090 PRINT AT 9,2;"©[redacted]
[redacted]©"
1100 PRINT AT 10,2;"©[redacted]
[redacted]©"
1110 PRINT AT 11,2;"©[redacted]
[redacted]©"
1120 PRINT AT 12,2;"©[redacted]
[redacted]©"
1130 PRINT AT 13,2;"©©©©©©©©©©©©©©
©©©©©©©"
1140 GO SUB 500
1150 PRINT "  The object of this
 game is to get your tank(▲) acr
oss the treacherous minefield,bo
rdered by electrified barbed wir
e;and to take with you vital mil
itary secrets back to base([redacted]).Ex
tra points can be gained by pick
ing up stranded soldiers(*).
1155 PRINT AT 0,6;"[redacted]
": PAUSE 1: PAUSE 0
1160 PRINT AT 14,2;"You have a m
ine detector to help you,which w
ill tell you how many mines are
adjacent to you.": [redacted]
1165 PRINT "You only have one li
fe,and when you are killed an ac
tion replay will show you where
you went wrong. [redacted]
[redacted]
1170 PAUSE 1: PAUSE 0: CLS : GO
TO 83
1500 LET j=(7.97*y): LET k=175-(
7.95*x+4)
1510 PLOT j,k
1515 FOR n=0 TO 7: PLOT j,k: BEE
P .001,20: DRAW INK 5;5*COS n-5,
5*SIN n+4: NEXT n
1520 FOR n=0 TO 7: PRINT INK n;A
T 10,7;"[redacted]": PAU
SE 15: NEXT n
1530 GO SUB 650
1540 GO SUB 400
1550 PRINT AT 10,5;"Another Go(Y
/N)": PAUSE 1: PAUSE 0
1560 IF INKEY$="n" THEN STOP
1590 RUN 83
```

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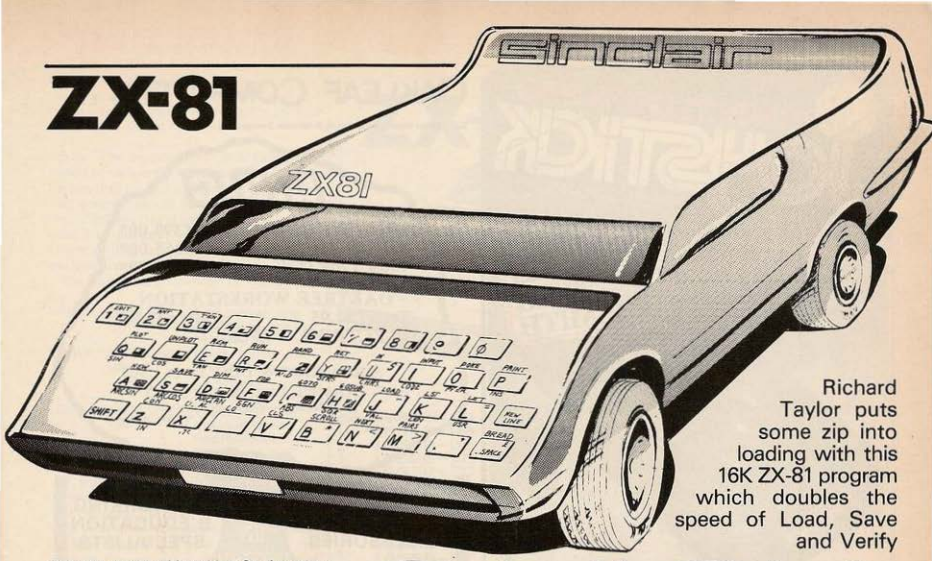
ZX-81



Richard Taylor puts some zip into loading with this 16K ZX-81 program which doubles the speed of Load, Save and Verify

QUICK LOAD

ARE YOU BORED with waiting for that new Space Invader program to load? Do you feel like throwing your ZX-81 out of the window when it fails to load the only copy of that new program which took five hours to type in for the third time? If so, then read on. This machine-code program for the 16K ZX-81 allows you to Save, Verify and Load programs at over twice the normal speed with as much, and probably more, reliability. The addition of the Verify facility enables you to be sure that you have transferred the program safely on to tape before you switch off your machine. In short, this program should save a great deal of time, tape and temper.

The machine code is held in a Rem statement at the beginning of the program. Type:

```
1 REM (256 Xs)
```

If you have done this properly,

```
PRINT PEEK 16770
```

will give 118. The hexadecimal code is shown in listing 1. Type in the hexadecimal loader program shown in listing 2. Now carefully enter the hex code from listing 1. You can enter more than one byte at a time for instance

```
CDE702
```

instead of

```
CD.E7.02
```

Where . represents a Newline.

When you have finished entering the code, press Newline. The machine will stop with an error report; do not worry about it. Now enter

```
POKE 16510,0
```

This changes line 1 into line 0 to protect the machine-code from being deleted by mistake. At this point it is a good idea to make a couple of copies of the program on tape in case the machine crashes. Now check to see if everything is working all right. Enter:

```
RAND USR 16514
```

but do not press Newline.

Find a blank part of a cassette, preferably a high quality one. Start the tape recorder recording and press Newline. The program should save in the way it usually does except that the lines should be closer together and more numerous. If this does not happen then you have probably made a mistake in entering the machine code. Re-load the copy of the program you made earlier and type in listing 3. When it is run you can check your code against that shown in listing 1 and correct your mistakes.

Rewind your cassette to the beginning of the high speed recording and type: to verify the recording:

```
RAND USR 16601 — without Newline
```

Start the tape and press Newline. The patterns should be the same as when you load a program normally, except the wide bands should be closer together. If this does not happen then check your listing, using the above method. When the recording is finished, the machine should stop with the

```
0/0
```

report. It may stop during the recording with an

```
R/O
```

error report. This signifies that the tape recording did not exactly match the contents of memory. This is probably due to the volume control being set at the wrong level.

The settings should be the same as for normal loading but sometimes a higher volume level is needed. Just keep altering the volume control and trying again. If it still does not work after a few more tries then it is probably due to something else. It may be because of interference from an outside source, check that the ear and power leads do not cross over one another. Make another recording of the program at high speed and try and Verify that recording. Another cause of problem may be that an error was made in entering the programn, check your listing.

Once the program has verified properly delete all lines except the one containing the machine code. We will now try and load the program back into the machine. Enter

```
RAND USR 16607
```

without Newline. Rewind to the beginning of

(continued on page 77)

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(continued from page 75)
the program and press play then press the newline key. When the recording has finished the machine should stop with the

O/O

report. The program that you have saved should be back in the machine. If this does not happen then try making another copy on tape. The program should load since if it verifies then it follows that it should load back. Now make a normal copy on tape of the program. Delete all lines except the one containing the machine code before you do this.

The three main functions of Quick Load are:

SAVE	RAND USR 16514	Save program and variables on tape at 650 level.
VERIFY	RAND USR 16601	Check that the contents of the tape are the same as in memory.
LOAD	RAND USR 16607	Delete old program and variables and load new ones in from tape at 650 level.

If you press Break during any of these operations the machine will stop with error D. The command can be used either in program lines or as direct commands, the latter being the most used. If the Save command is in a program then execution of the next program line will occur after the program has loaded. In this way you can have Autorun programs using quick load. To load a program at high speed, the program must contain the machine-code Rem statement itself and the program you wish to save at high speed must not contain any machine code in Rem statements. Use the following method: first, lower RAMtop by entering

POKE 16389,127

and then New; second, load the quick load program; third, type in listing 4 and run it in fast mode; next, type New; then load the program you wish to use Quick Load on. Now type in line 1 Rem statement followed by 256 xs. Then type in the rest of listing 5 and Run it in Fast mode. Enter

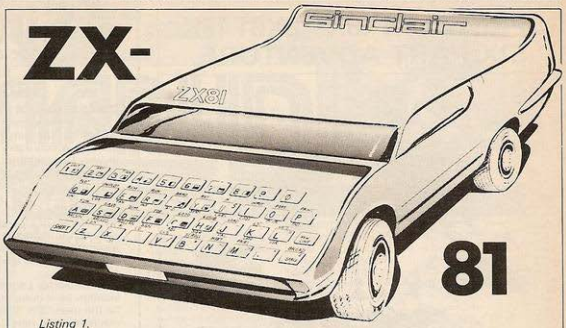
POKE 16510,0

to protect the Rem statment and delete listing 5, lines 10 onwards, finally, Save and Verify it at high speed.

You may have to change the line numbering of the first few lines when you type in listing 5 so that you do not overwrite part of the program. If you intend to use quick load on a program you want to write or type in just load Quick Load before you start.

Unfortunately, you cannot give names to programs saved using Quick Load. Verify and Load work in a similar way to Load quote-quote which acts on the first program it comes to. I would suggest that you use Quick Load in the following way: keep a side of a cassette just for programs saved using Quick Load. Record a copy of Quick load at normal speed. After that are the actual programs saved at high speed. When you want to load a program from the cassette you must first load Quick Load and use its Load command to copy the actual program into memory. Always use verify straight after saving as any change in the program or variable will cause error R to occur when you verify even if the recording is loadable.

ZX-81



Listing 1.

```
16514-CD E7 02 21
16518-A0 0F 10 FE
16522-3E 7F DB FE
16526-1F 30 3D 28
16530-7C B5 20 F2
16534-21 0A 40 4E
16538-37 CB 11 28
16542-21 9F E6 03
16546-C6 02 5F D3
16550-FF 06 22 10
16554-FE 3E 7F DB
16558-FE 1F 30 1C
16562-06 20 10 FE
16566-1D 20 EC 06
16570-6E A7 10 FD
16574-18 DB 23 EB
16578-2A 14 40 37
16582-ED 52 EB 30
16586-CE C3 07 02
16590-3F FF 32 27
16594-40 FD CB 38
16598-86 CF 0C FD
16602-CB 09 CE 18
16606-04 FD CB 09
16610-8E CD E7 02
16614-FD CB 09 86
16618-18 1D 0E 01
16622-06 00 3E 7F
16626-DB FE D3 FF
16630-1F 30 47 17
16634-17 38 67 10
16638-F1 F1 FD CB
16642-09 46 20 49
16646-21 0A 40 11
16650-0F 41 D5 13
16654-DD FD CB 09
16658-C5 FD CB 09
16662-4E 28 04 79
16666-BE 20 38 71
16670-23 EB 2A 14
16674-40 37 ED 52
16678-EB 30 E0 22
16682-14 40 36 76
16686-23 36 7F 23
16690-36 76 23 22
16694-1A 40 22 1C
16698-40 C3 07 02
16702-18 AE FD CB
16706-09 46 28 38
16710-FD CB 09 4E
16714-20 82 C3 E5
16718-03 FD CB 09
16722-4E CA E5 03
16726-CF 1A E5 11
16730-7D 40 B7 ED
16734-52 E1 38 BC
16738-CF 1A 1E 00
16742-06 16 1C DB
16746-FE 17 38 F8
16750-10 F8 7B FE
16754-24 38 C9 FE
16758-5A 3F CB 11
16762-30 C2 C9
```

LISTING 3

```
1000 LET A=16514
1010 PRINT A;"-";
1020 FOR B=A TO A+7
1030 LET C = PEEK B
1040 PRINT CHR$(28+INT
     (C/16));CHR$(28+(C-
     16*INT(C/16)));" ";
1050 NEXT B
1060 LET A=B
1070 GOTO 1010
```

LISTING 2

```
10 LET A=16514
20 LET A$=""
30 IF A$="" THEN INPUT
   A$
40 POKE A,16*CODE A$+
   CODE A$(2)-476
50 SCROLL
60 PRINT A,A$ (TO 2)
70 LET A$=A$(3 TO)
80 LET A=A+1
90 GOTO 30
```

LISTING 4

```
10 FOR A = 0 TO 250
20 POKE 32512+A,PEEK
   (16514+
30 NEXT A
```

LISTING 5

```
0 REM (256 X'S)
10 FOR A =0 TO 250
20 POKE 16514+A,PEEK
   (32512+A)
30 NEXT A
40 STOP
```

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DISASSEMBLER

Alan Westwood's disassembler turns those tricky chunks of hexadecimal machine-code into easier mnemonics.

MACHINE CODE is a binary code written in memory, each code representing a microprogram written into the processor when it is manufactured. To make it easier for us humans to read, a program can be written to convert this into hexadecimal form. This makes things easier, but is far from ideal. The next step is to substitute mnemonic or assembler code for machine code, and this is the purpose of a dissassembler — it translates machine code into mnemonic code. The next step is to a high-level language such as Basic or Forth.

The Vic-20 uses the 6502A microprocessor, a fast version of the 6502 used in the BBC, Pet, and Apple. There are 56 separate mnemonics, and 13 different addressing modes on the 6502 — see figure 1. If you are a beginner in machine code, and you have been following *Your Computer's* series on 6502 machine code, you may find this a handy table to have by your side. Each op-code is represented by a combination of mnemonic and addressing mode. I used this fact to help write the Vic disassembler.

The logic of the system

The main idea was to use the machine-code byte as a pointer to a two-dimensional array, each member of the first dimension pointing in turn at the mnemonic code, and each corresponding member of the second dimension pointing at a routine to handle the addressing mode; figure 2 should make this clearer.

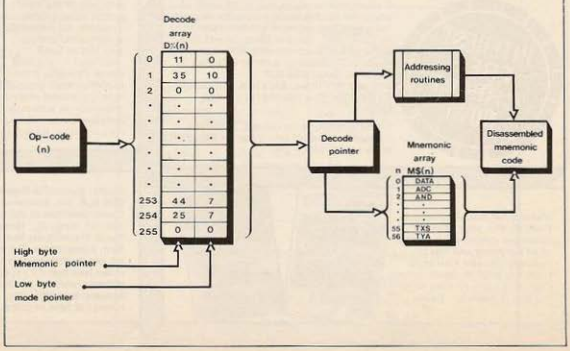
However, in order to fit this into an unexpanded Vic, the decode data had to be compacted. So instead of entering the data straight, I used ASCII character codes. Thus each Decode line is represented by two ASCII characters, the first being the mnemonic pointer, and the second the mode pointer. When the disassembler is run further compacting takes place. The two ASCII codes of the data for each decode line are packed into a single member of a one-dimensional integer array. Each member of an integer array is a two-byte variable in a low-byte and high-byte format. The mnemonic pointer is manipulated into the high byte and the mode pointer into the low byte of the corresponding array member. Therefore each op-code is represented by a single array member, and the whole array occupies just over 500 bytes. This process saves approximately 1.5K of memory.

I have written the program in as structured a way as possible in order that it should be easy to add new functions to it. Also all addresses, codes, and operands are printed in hex in order to fit it on the Vic screen. Here, to help you enter it, is a description of the program. Firstly all Rem statements should be left out, as otherwise you may run out of memory when running the disassembler.

Program description

Lines 10-90 load the data into the arrays D%(i) and m$(i) being the decode array and the mnemonic array respectively. In line 16 the strange control character is a shifted-reversed-M. It is not directly available from the keyboard so first type the line with spaces

Figure 2. System logic for Vic disassembler.



where it occurs, then go back over the line and type Cntl-Rvs to enter reverse mode then shift-M in the appropriate places. Before you enter the line make sure it is correct as this character affects the listing. It is a very neat trick to know and it saves a lot of cursor control characters.

Line 18 waits for the shift key to be pressed, ignoring all others, including Run/Stop.

Line 60 packs the data into the decode array. A1 is the mnemonic pointer and A2 is the addressing mode pointer. Line 100 is the input line for a new start address for dissassembly. The address must be entered in hex to be correctly interpreted.

Line 120 unpacks the pointers from D%(i), D2-mnemonic pointer, D3-address mode pointer and Line 150 uses D3 to jump to the appropriate address routine. If D3=0 then this line is ignored (implied addressing).

Line 160 prints the dissassembled code, AD$-address, OP$-the actual code, MN$-mnemonic string, TV$-operand string. Lines 170-190 Get the next command from the user. This is where you could put commands to control printer output or a dump to disc, or cassette. Line 2000 is the hex to decimal routine; the decimal to hex routine is at line 1000.

Entering data statements

The decode data statements are at lines 9000-9150. As indicated in the listing the data statements are best entered in lower case mode, as several of the graphic characters are very similar, and would be unreadable from the magazine. Note: the pound is a genuine pound character and not a hash character.

Line 9190 is a checksum: if this does not tally with the total of the data the program will print Data Error and stop. Lines 9210-9260 are mnemonic data; the first mnemonic is Dat and represents op-codes not implemented on the 6502.

Now run the program. It will first print a menu of commands, and then wait for the shift key to be pressed. A short pause will follow and all being well the input prompt

START-ADDRESS ?

will come up on the screen. Now enter 73, and as each dissassembled line comes up, press any key to get the next line. Eventually the screen will look like figure 3, if it does not then you have made a typing error. The program description should help you find the bus. What you should now have dissassembled is the routine used by the Basic interpreter to get the next Basic character. If you have not already saved the program now is the time.

Now you have the program up and running, you will want somewhere to start dissassembly. Figure 4 is a list of addresses of

(continued on page 83)

Figure 4.

FF7F 65405 This is the break — software interrupt — vector's vector.

FF82 65407 Interrupt request, used by the operations system to update the system clock every 0.016 seconds, and to scan the keyboard.

FF8A 65415 Restores all system variables to their default values and also resets the interrupt vectors in RAM.

FF8D 65417 Calling this routine with the carry flag set will put all the RAM vectors into a list starting at an address in the X and Y registers. With the carry clear, it copies a list from an address in the X and Y registers to the system vectors in RAM.

FF99 65433 Called with the carry clear, the X and Y registers will be loaded into the top of memory pointer. With the carry set, it will read the values into the X and Y registers.

FF9C 65436 This is the same as the previous routine, except it changes the bottom of memory pointers.

FF9F 65439 This routine scans the keyboard and the ASCII value of the key will be put into the keyboard buffer.

FFCC 65484 Sets the input-output channels. Keyboard input and Screen is output.

FFD5 65493 If the accumulator is equal to zero Loads RAM from cassette — or any other device. If accumulator equals one, it verifies RAM.

FFD8 65496 Saves RAM from an indirect zero-page address contained in the accumulator up to the address in the X and Y registers on to cassette or disc. Note for this routine and the previous routine to work correctly further routines need to be called.

FFDB 65499 Set the system clock. The accumulator holds the highest byte, X the next byte, Y the lowest byte.

FFE1 65505 Scans the Stop key. If the Stop key is pressed then the zero flag will be set.

FFE4 65512 Gets an ASCII character from the keyboard butter and puts it into the accumulator. If the buffer is empty then the accumulator is equal to zero.

FFEA 65514 Updates the system clock.

FFF0 65520 Sets/Reads the cursor position. If the carry is set, the column position of the cursor is returned in the X register and the line number in the Y register. If the carry is clear then the cursor is moved to the position indicated by the X and Y registers.

Figure 1.

```
Mnemonics
00 DAT  14 CLC  28 JMP  42 RTI  56 TVA
01 ADC  15 CLD  29 JSR  43 RTS
02 AND  16 CLI  30 LDA  44 SBC
03 ASL  17 CLV  31 LDX  45 SEC
04 BCC  18 CMP  32 LDY  46 SED
05 BCS  19 CPX  33 LSR  47 SEI
06 BEQ  20 CPY  34 NOP  48 STA
07 BIT  21 DEC  35 ORA  49 STX
08 BMI  22 DEX  36 PHA  50 STY
09 BNE  23 DEY  37 PHP  51 TAX
10 BPL  24 EOR  38 PLA  52 TAY
11 BRK  25 INC  39 PLP  53 TSX
12 BUC  26 INX  40 ROL  54 TXA
13 BVS  27 INY  41 ROR  55 TXS
Addressing modes
0 implied            7 absolute,x
1 accumulator        8 absolute,y
2 immediate          9 relative
3 zero page         10 (indirect,x)
4 zero page,x       11 (indirect),y
5 zero page,y       12 (indirect absolute)
6 absolute
```

Figure 3.

```
73   E67A   INC7A
75   D002   BNE79
77   E67B   INC7B
79   AD5007 LDA@750
7C   C93A   CMP@3A
7E   B00A   BCS8A
80   C920   CMP@20
82   F0EF   BEQ73
84   38     SEC
85   E930   SBC@30
87   38     SEC
88   E9D0   SBC@D0
8A   60     RTS
```

Branch instructions are printed with their absolute destinations and not their relative offsets. Also the @ character represents immediate addressing. The address in line 4 (0750) will differ depending on the amount of memory expansion.

Disassembler listing.

```
 5 REM VIC-DISSASSEMBLER C.1983 A.WESTWOOD
10 DIMD%(255),M$(56):POKE36879,110
14 REM THE "■" CONTROL CHARACTER IN THE NEXT LINE IS A REVERSED SHIFTED M
15 REM FIRST TYPE A SPACE WHERE THE "■" OCCURS THEN GO OVER AFTER THE LINE HAS
BEEN ENTERED
16 PRINT"■■CONTROL KEYS ARE:-■■F1-START ADDRESS■■F3-DECIMAL TO HEX■■F5-HEX
TO  DECIMAL"
17 PRINT:PRINT"PRESS SHIFT KEY"
18 WAIT653,1
20 PRINT"■LOADING DATA■PLEASE WAIT"
30 FORI=0TO255
40 IFA1$=""THENREADA1$
50 A1=ASC(A1$):A2=ASC(MID$(A1$,2))-48:A3=A3+A2+(A1+((A1>191)*96)-48)
60 D%(I)=(A1+((A1>191)*96)-48)*256+A2
70 A1$=MID$(A1$,3)
80 NEXTI
85 READCS:IFCS<>A3THENPRINT"DATA ERROR":END
90 FORI=0TO56:READM$(I):NEXTI:PRINT"■"
100 INPUT"■■START ADDRESS■■■":AD$:H$=AD$:GOSUB2000:AD=D
110 B=PEEK(AD)
120 B1=D%(B):B2=(B1AND(127*256))/256:B3=B1AND255
130 MN$=M$(B2):D=AD:GOSUB1000:AD$=H$
140 TV$="":D=B:GOSUB1000:OP$=H$:AD=AD+1
150 ONB3GOSUB200,300,230,350,400,450,500,550,600,650,700,750
160 PRINTAD$TAB(5)OP$TAB(12)MN$TV$
170 GETQ$:IFQ$=""THEN170
175 IFQ$=CHR$(133)THEN100
180 IFQ$=CHR$(134)THENINPUT"■■INPUT DEC■■■":D:GOSUB1000:PRINTTAB(10)H$:GOTO170
185 IFQ$=CHR$(135)THENINPUT"■■INPUT HEX■■■":H$:GOSUB2000:PRINTTAB(10)D:GOTO170
190 GOTO110
200 TV$="A":RETURN
230 GOSUB240:TV$=TE$:RETURN
240 D=PEEK(AD)
250 GOSUB1000:TE$=H$:OP$=OP$+H$:AD=AD+1:RETURN
300 GOSUB240:TV$="■@■■"+TE$:RETURN
350 GOSUB240:TV$=TE$+",X":RETURN
400 GOSUB240:TV$=TE$+",Y":RETURN
450 GOSUB240:TV$=TE$:GOSUB240:TV$=TE$+TV$:RETURN
500 GOSUB450:TV$=TV$+",X":RETURN
550 GOSUB450:TV$=TV$+",Y":RETURN
600 AF=PEEK(AD):GOSUB240:AF=(AD-1-(AF<128)*(AF+1)-(AF>127)*(AF-255)):D=AF:
GOSUB1000
```

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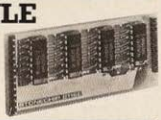

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(continued from page 81)

routines, and a brief description of their functions, found in a section of the ROM called the kernal. When you dissassemble these addresses you will find it to be a jump table. The reason for not jumping directly to the routines is that if the Vic operating system is updated, then although the operating system routines may move in memory, the jump table will not. Therefore, if your machine-code programs use the kernal they will require the minimum of alteration, saving time and effort. This is a common practice in micros and is called indirection. Having said that, here are a few routines you can use profitably from Basic — most of the routines are best called from machine code as they require various flags to be set. The SYS basic command allows the accumulator, X, and Y registers to be passed as paramaters to the machine code routine, by Poking the values into the following addresses: accumulator-780, X-781, Y-782.

A useful facility

The ZX-81 has a Print At instruction and it would be useful if the Vic had this facility so instead of using masses of cursor controls, try the following: Poke 781,line number:Poke 782,,column number:SYS65520 and Print an asterisk. Voila! Print At on the Vic. Or try SYS 59765; this will scroll the screen up one line. Or again Poke 781,line number:Poke 782,21:SYS 60047 will blank that complete line — Poking 782 with other numbers will blank that number of characters. Now you have the tools you can start digging.

(listing continued from page 81)

```
610 TV$=H$:RETURN
650 GOSUB240:TV$="("+TE$+",X)":RETURN
700 GOSUB240:TV$="("+TE$+"),Y":RETURN
750 GOSUB480:TV$="("+TV$+")":RETURN
1000 H$=""
1010 IFDTHENA=INT(D/16):H$=MID$("0123456789ABCDEF",1+D-A*16,1)+H$:D=A:GOTO1010
1020 IFLEN(H$)=3ORLEN(H$)=1THENH$="0"+H$:RETURN
1030 IFH$=""THENH$="00"
1040 RETURN
2000 D=0:IFH$>""THENFORI=1TOLEN(H$):A=ASC(MID$(H$,I,1))-48:D=D*16+A+(A>9)*7:
NEXT :RETURN
2010 RETURN
8000 REM AS SOME OF GRAPHIC CHARACTERS ARE VERY SIMILAR THE DATA STATEMENTS
SHOULD BE ENTERED IN LOWER CASE MODE
8010 REM IN LINES 9040 AND 9060 THE 25TH CHARACTER IS A LOWER CASE L (1).
THE"-" IS A SHIFTED *

8900 rem DECODE DATA
9000 data"10:000000:33300:00:2310000:63600"
9010 data"19:000000:43400:0:8000000:73700"
9020 data"62:00007323:300:022:1007626:600"
9030 data"092:00000024:400302800000027:700"
9040 data"20h:000000h34300h2410016h6:600"
9050 data"<9h:000000h44400h8000000h7:700"
9060 data"10:00000013:300:012:1001(16:600"
9070 data"=91:00000014:400:0180000017:700"
9080 data"00-:0000B3-3A300:000F00006-6A600"
9090 data"49-:0000B4-4A500H0-8000000-70000"
9100 data"=2h:0200:3:3:300D0h2C000:6:6:600"
9110 data"59h:0000:4:4:500:0:8C000:7:7:800"
9120 data"d2b:0000d3b3:300:0b2:f000d6b6:600"
9130 data"99b:000000b44:400:0b8000000b7:700"
9140 data"c2f:0000c3f31:300:0f2:f000c6f6:600"
9150 data"69f:000000f41400:0f8000000f7:700"
9160 rem CHECKSUM
9190 data4861
9200 rem MNEMONICS
9210 datadat:adc:and:asl:bcc:bcs:beq:bit:bmi:bne:bpl
9220 databrk:bvc:bvs:clc:cld:cli:clv:cmp:cpx:cpy
9230 datadec:dex:dey:eor:inc:inx:iny:jmp:jsr:lda
9240 dataldx:ldy:lsr:nop:ora:pha:php:pla:plp:rol
9250 dataror:rti:rts:sbc:sec:sed:sei:sta:stx:sty
9260 datatax:tay:tsx:txa:txs:tya
```


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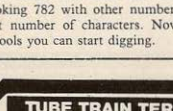
(ZX Spectrum – 48K)
by Douglas Elliott



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CLEAR1000,32256

and Load the decimal machine codes, using data statements to Poke them to the correct addresses. Save this as a machine-code tape file. The routines' functions are to paint in the ground, to vibrate the screen display when you are hit, and to print an instant explosion when you hit the enemy aircraft.

Next, Load the Basic. The program uses 30K when running.

Once you have the Basic entered, Save it on tape, and Run the program, which will set the limits of the Basic system, as well as putting the processor into dual clock mode. You will need to type

POKE&HFFD6,0

before using the cassette interface, to revert to normal mode.

Unless you are an experienced aerobatic pilot, I suggest that you start without the additional complication of enemy aircraft. To remove these, alter lines 435, 505 and 2095 of the Basic by editing a Rem into the very beginning of each line. This deactivates them.

On the left-hand joystick up and down control your engine speed, in the range 600-2,500 rpm. Engine speeds below 1,700 slow you down, while above that, they speed you up. Left and right control the rudder. The button gives you an updated instrument reading.

On the right-hand joystick left and right control your ailerons, giving roll, and of course, consequent turn. Do not forget that the horizon appears to go the opposite way to the direction of bank. Up and down control your elevators, and give climb and descent, with loss or gain in airspeed as appropriate. The button gives a map except when there are enemy aircraft about, in which case it fires the guns. I shall give you more details about the map later.

Now for the functions of individual keys. M will give a map at any time, showing the aircraft as a small square, and the runway as a box. The two lines south of the runway are the landing entry zone. Also included is a fuel guage, one of your most vital instruments, as when you run out of fuel, the engine speed drops to 600 and the aircraft flies like a brick.

F is a useful key which puts you back to straight and level at 3,000 feet at a moderate speed. This is a useful panic button if you get really disorientated, but unfortunately is not present on the real thing.

G lowers the undercarriage at speeds below 120 knots. It also raises the undercarriage after take-off.

F lowers the flaps during landing, at speeds below 140 knots. This lowers your stalling speed to 60 knots, but does not affect the stall warning buzzer.

O performs an overshoot on landing, taking you out of the landing routine, and putting you back in free flight. R and C are used as a pair, to initiate and cancel an offset roll respectively. S is used to start the engine before take-off.

Four instruments are shown at the base of the screen: ASI — airspeed, RPM — engine speed — ALT — altimeter — and HDG — heading. These are updated by pressing the left joystick button.

If your ASI drops below 7 on the gauge — 70 knots — you will spin. You must then immediately put the right stick fully forward, and you will recover in a dive. If you are below 2,000 feet you will not recover in time.

You hear a stall warning horn at less than 80 knots. You must watch the upper limit, VNE — velocity never exceed — as, if you exceed this, the wings fall off. This also has a warning whistle at 7 knots below VNE. VNE is usually 240 knots.

RPM is self-explanatory, controlled by the

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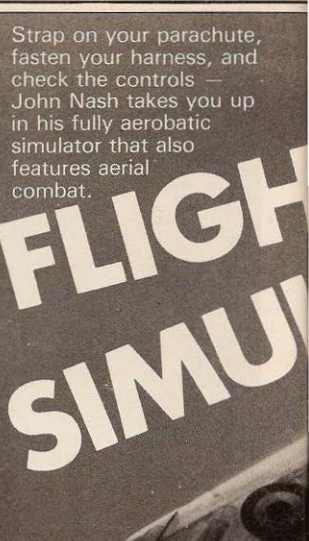

```
7 POKE&HFFD7,0
8 CLEAR1000,32250
9 PCLEAR8
10 HA=96:YF=0:YD=0:XD=0:ES=0:AM=50:VN=240:MR=2500:LV=RND(3)
11 HT=3000:SP=120:HD=0:RP=2000:FU=40: INITIALISE AIRPLANE
15 GOSUB9000
20 DIMGR(100):DIMXA(100):DIMYA(100):DIMAR(25)
23 PMODE3:PCLS
24 FORN=1 TO 4:PCOPYM TO (M+4):NEXTN
25 LINE(0,144)-(254,148),PSET,BF:LINE(0,148)-(4,192),PSET,BF:LINE(251,148)-(254,
192),PSET,BF
26 GOSUB10000:GOSUB2000:REM DRAW STRINGS
27 FORN=1 TO 4:PCOPYM TO (N+4):NEXTN
30 FORN=1 TO 12:GR(N)=96/(N+8):NEXTN
40 FORN=13 TO 24:GR(N)=(96-8*(N-12))/96:NEXTN
50 FORN=25 TO 37:GR(N)=-8*(N-24)/96:NEXTN
60 FORN=38 TO 48:GR(N)=-96/196-8*(N-37):NEXTN
70 FORN=50 TO98:GR(N)=GR(N-49):NEXTN
80 GR(1)=5000:GR(49)=5000:GR(98)=5000
90 ER=1:UD=-1:REM ERECT SU/DOWN FLAGS
100 FORN=1 TO 49:XA(N)=SIN(ATN(GR(N))):NEXTN
101 FORN=50 TO 98:XA(N)=-XA(N-49):NEXTN
102 FORN=1 TO 49:YA(N)=COS(ATN(GR(N))):NEXTN
103 FORN=50TO98:YA(N)=YA(N-49):NEXTN
104 XA(49)=-1:XA(98)=1:YA(49)=0:YA(98)=0
105 AX=120:AY=96
400 N=24
410 CLS
420 PRINT"TAKE-OFF (T)";PRINT"START AT 3000 FT (S)";PRINT"OR LAND(L)?"
424 PRINT "more"(CHR$(128));"information"
425 PRINT"DURING FLIGHT,'F' PUTS YOU","BACK TO STRAIGHT AND LEVEL","'L' STARTS L
ANDING, BUT ONLY","IF YOU ARE JUST SOUTH OF FIELD","AT 1000FT";PRINT"'G' OPERATE
S GEAR";PRINT"'F' OPERATES FLAPS","'O' TO OVERSHOOT","'R' TO INITIATE OFFSET ROL
L"
426 PRINT"'C' TO CANCEL OFFSET ROLL";PRINT"(S) TO START ENGINE"
430 G$=INKEY$:IFG$=""  THEN430
435 CLS:PRINT"THIS IS THE ATTACK VERSION","IN WHICH THE RH BUTTON SHOOTS","AT TH
E ENEMY AIRCRAFT.","  THE BUTTON GIVES YOU A MAP","WHEN NO A/C PRESENT.","YOU C
AN SET A MAP BY PRESSING","(M) ANY TIME."
436 FORN=1 TO 2000:NEXTN
440 IFG$="T" THEN 3100
445 IFG$="L" THEN HT=1000:SP=100:AX=120:AY=115:GOTO7020
490 PMODE3:SCREEN1,1:PCLS
500 REM LOOP
501 IFN=98 THEN N=1
505 GOSUB4600
510 IFJOYSTK(0)<32 THEN N=N+1:IFJOYSTK(0)<12 THEN N=N+2
520 IF JOYSTK(0)>42 THEN N=N-1:IFJOYSTK(0)>52 THEN N=N-2
530 IFN>97 THEN N=1
540 IFN<1 THEN N=97
550 IF N>48 THEN ER=-1 ELSE ER=1
640 X1=0:X2=256
641 REM ADJUST Y FOR PITCH
642 IF YF<>0 THEN CIRCLE(108,182),5
800 REM PITCH
810 V=0/(ABS(GR(N)+1)
820 IF JOYSTK(1)<32 THEN HA=HA-V/2:IFJOYSTK(1)<12 THEN HA=HA-V:IF JOYSTK(1)<2 TH
EN HA=HA-V
825 IF JOYSTK(1)>42 THEN HA=HA+V/2:IFJOYSTK(1)>52 THEN HA=HA+V:IFJOYSTK(1)>61 TH
EN HA=HA+V
826 XD=JOYSTK(1)
830 IF HA<192 THEN HA=192:UD=-UD:YF=-YF
840 IF HA>384 THEN HA=0:UD=-UD:YF=-YF
845 IF UD=1 AND N<49 THEN N=N+49:UD=-1:GOTO500
846 IF UD=1 AND N>49 THEN N=N-49:UD=-1:GOTO500
847 G$=INKEY$
848 IF G$="R" AND HA>0 AND HA<192 THEN YD=ER*(HA-96):YF=ER:REM OFFSET ROLL
849 IF G$="C" THEN YD=0:YF=0:XD=0
850 IF G$="F" THEN N=24:HA=96:ER=1:YF=0:YD=0:XD=0:SP=120:HD=0:RP=2000:GOTO500
851 IFGR(N)=0 THEN XD=0:GOTO863
852 RF=YD*YA(N)
860 XD=YD*XA(N)
861 X1=XD+128-128/ABS(GR(N)):IFX1<0 THEN X1=0
862 X2=XD+128+128/ABS(GR(N)):IFX2<0 THEN X2=0
863 Y1=HA-96*(GR(N)):IF YF=-ER THEN Y1=Y1+RF*ER*2
864 Y2=HA-96*(GR(N)):IF YF=-ER THEN Y2=Y2+RF*ER*2:REM ROLL OFFSET
865 IFX1>256THENX1=256
866 IFX2>256THENX2=256
867 IFY1>192THENY1=192
868 IFY2>192THENY2=192
869 IFY1<0 THEN Y1=0
870 IFY2<0 THEN Y2=0
```

(listing continued on page 89)

left stick, and has a range of 6–25 multiplied by 100. Higher speeds use more fuel, but climb better, and increase your airspeed.

ALT shows your height in units of 10 feet for take-off and landing, and units of 100 feet for normal flight.

HDG is the bearing on which you are flying, in units of 10 degrees.

The map will show your movements, so flying on a heading of 00, you will go upwards on the map. Note that you can fly right off the map and will then see nothing.

G and F appear at the base. When short black lines are present this indicates that your flaps or gear are down.

You are now ready for take-off. Run the program, and select T on the prompt. You will get a runway display. Put on full power, and press S. The display will start to move.

Press the left button from time to time; it is better not to hold it in as this slows things down. When ASI reaches 60, pull back on the right stick. You will now take off. When the horizon reaches the base of the screen, put the stick back to centre, to maintain the rate of climb. Retract your gear with G. When you reach 500 feet, all the controls and display start to work fully.

Aerobatics are best done at over 2,000 feet, because of the risk of spinning. I cannot teach you to fly, but here are some guidelines.

To roll, put your nose a little above the horizon, speed 140-180, and roll with aileron, the right stick. Support the nose with upgoing rudder — left stick — when the wings are vertical. The program simulates the way the nose drops in the roll quite realistically. To loop; get as much airspeed as you can and then pull hard to lift the nose. Eventually, the ground will reappear, first inverted, then erect, provided you do not stall. Outside loops are also possible: you push forward on the joystick.

Flat turns can be achieved with rudder alone, and combinations of manoeuvres can be achieved, but one special one is the offset roll. This is rolling while climbing or diving. Because of the display method, you must lock the offset by pressing R after setting the rate of climb or descent, and before rolling. When the roll is complete, cancel the offset with C. During the offset roll, you will see a small circle on the instrument panel.

If you do not want the bother of taking off, you can start at 3,000 feet by replying 3 to the initial T, L or 3 prompt.

You can practise landing by replying L to the initial prompt, which will put you on final approach. The more conventional procedure is to place yourself in the area demarcated by the two horizontal lines on the map, at just below 1,000 feet, and on a heading of 330 — 30 degrees, roughly north. If you then press L, you will enter the landing routine. Put your wheels and flaps down — F and G — which will only work if your speed is below 120 and 140 knots, respectively. Control your heading with the rudder to keep the runway central. Descend quickly until you are close to the runway, then round out.

You can only land if your speed is below 90 knots, and the horizon is approximately in the

(continued on page 89)

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(continued from page 87)

middle of the screen. If you mess it up, you will get various messages, but you can press O at any time before landing, and go round again.

When you have mastered the aircraft, try taking on some enemy planes. Reactivate the three lines — 435, 505, 2095 — and Run.

As soon as you have left the take-off display, an enemy aircraft will appear after a random time, heralded by a beep. He is flying at 160 knots, and will get larger if you catch him up. He dodges, again randomly, and fires off salvoes of four rockets at you, which stay on the screen for a time proportional to the distance between you and him. At the moment these rockets leave the screen, if they are within your gunsight, you will be hit, and receive a damage or "bale out" report. Baling out is automatic, accompanied by a spectacular display.

You can interrupt the program with Break at any time, and restart with Goto12000. If you have done any editing, however, you must use Run, as editing clears all the variable arrays, and Run resets them.

The alterations shown at the end of the main program will make the Dragon Flight Simulator controllable from the keyboard. The simulator is a little harder to fly, although still quite usable. It was necessary to make the elevator, aileron and rudder controls self-centring, as, with no stick to indicate the current settings, one soon becomes very confused.

The instructions need some modification, which I have built into the display screens at the beginning of the program. The main differences are that the aircraft joystick — previously the right-hand joystick — is now controlled by the arrow keys, operating as you would expect — the joystick forward function is now performed by the up arrow. The other control alterations are explained in the listing.

You have to keep pressing S to keep turning to the right. Similarly with the arrow-keys you have to keep pressing the up-arrow to keep pitching up, when doing a loop. If you want to alter the pitch rate, this can be achieved by altering 820 and 825. Try altering HA by

+/-2*V

per key press, if you think the pitch too sluggish. The joystick version gives three different pitch rates according to stick deflection. You will also have to be quick to reduce your rpm when entering the landing routine, or you will overshoot.

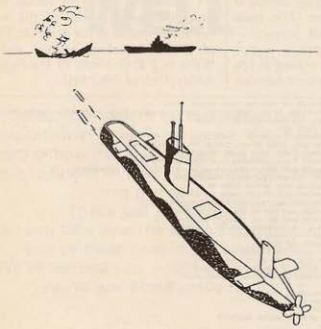
I would be happy to oblige readers by supplying taped copies of the joystick or keyboard version of the program, for the sum of £4.85, including postage and packing. Write to J R G Nash, 30 Hutchcome Road, Botley, Oxford OX2 9HL.

(listing continued from page 8)

```
871 IFX1>256THENX1=256
872 IFX2>256THENX2=256
873 IFX1<0THENX1=0
874 IFX2<0THENX2=0
901 IFX1<0 AND X2>0 OR X1>256 AND X2>256 THEN PCLS:GOTO 500
910 REMUPDATE INSTRUMENTS
915 RU=JOYSTK(2)
920 RP=2500-(30*JOYSTK(3));IF RP>MR THEN RP=MR
925 FU=FU-RP*35/(1800*1800)
926 IF FU<0 THEN RP=600
930 HT=HT-(9*HA)/8
935 IF HT<10 THEN GOTO5000
940 SP=SP-ER*(HA*96)/10+(RP-1700)/80;IFER=-YF THEN SP=SP-YD/5
945 IF SP>140 THEN SP=SP-(SP-140)/12.5:REM AERODYNAMIC DRAG
945 IFSP>(VN-7) THEN GOSUB4500:REM VNE WARNING
950 IFSP<80 THEN GOSUB4000:REM STALL WARNING
955 IFSP>VN THEN GOTO5000:REM VNE
960 IF SP<70 THEN GOTO5000:REM SPIN
963 REM RANGE DROPPING IN ROLL
964 HA=HA-&*ER*ABS(3A(N))-((RU-32)/4)*SGN(ER(N))
970 HD=HD+3A(N)*ER*D;HD=HD+(RU-32)*8*ABS(YA(N))*ER/32;IFHD>359 THEN HD=HD-359
971 IFHD<0 THEN HD=HD+360
974 AX=AX+SIN(HD/57)*SP/720:AY=AY+COS(HD+180)/57)*SP/720
975 PEEK(65280);IF PEEK=126 OR PE=254 AND AX>0 AND AY<1 THEN GOSUB8500
976 IFPE=126 OR PE=254 THEN GOSUB6000
980 PE=PEEK(65280):IFPE=125 OR PE=253 THEN GOSUB3000
985 IFDA="M" THEN GOSUB6000
990 IF DA="L" THEN GOTO 7000
991 DA=""
998 PCOPY 8 TO4:PCOPY 7 TO3:PCOPY 6 TO 2:PCOPY 5 TO 1:IFV1<=0 AND V2<=0 THEN GOT
O 1015
999 IF V1>=192 AND V2>=192 THEN1016
1000 LINE(X1,Y1)-(X2,Y2),PSET
1010 REM M/C PAINT ROUTINES
1015 IFV1<=0 AND V2<=0 AND ER=1 THEN POKE32766,6:POKE32767,0:POKE32762,24:POKE32
763,0:EXEC32256:GOTO1490
1016 IFV1>=192 AND V2>=192 AND ER=-1 THEN POKE32766,6:POKE32767,0:POKE32762,24:P
OKE32763,0:EXEC32256:GOTO1490
1020 IFER=-1 AND V1>=V2 THENPOKE(32766),6:POKE(32767),0:POKE(32762),6+(V1-3)*32/
256:POKE(32763),0:EXEC32256
1030 IFER=1 AND V1<V2 THEN POKE(32766),6+(V1+4)*32/256:POKE(32767),0:POKE(32762)
,24:POKE(32763),0:EXEC32256
1040 IFER=-1 AND V1<V2 THEN POKE(32766),6:POKE(32767),31:POKE(32762),6+(V2-3)*32
/256:POKE(32763),0:EXEC32303
1050 IFER=1 AND V1>=V2 THEN POKE(32766),6+(V2+3)*32/256:POKE(32767),127:POKE(327
62),24:POKE(32763),31:EXEC32303
1490 IF U0=1 THEN U0=-1
1500 GOTO500
2000 REM SET UP GAUGES
2010 P=INT(SP/100)0=INT(SP-100*P)/10:P=P+10:D=D+10
2020 S#=A#(P)+A#(D)
2030 P=INT(RP/1000):D=INT(RP-1000*P)/100:P=P+10:D=D+10
2040 R#=A#(P)+A#(D)
2050 P=INT(HT/1000):D=INT(HT-1000*P)/100:P=P+10:D=D+10
2060 H#=A#(P)+A#(D)
2070 P=INT(HD/100):D=INT(HD-100*P)/10:P=P+10:D=D+10
2080 D#=A#(P)+A#(D)
2090 DRAW "BM18,176;S12"
2095 CIRCLE(128,96),7
2100 DRAW"
2110 DRAW"BM48,176"
2120 DRAW"
2130 DRAW"BM126,176"
2140 DRAW"
2150 DRAW"BM180,176"
2160 DRAW"
2200 RETURN
3000 REM UPDATE DIALS
3010 PCLS:GOSUB2000
3020 LINE(0,144)-(256,148),PSET,BF:LINE(0,148)-(4,192),PSET,BF:LINE(251,148)-(25
6,192),PSET,BF
3030 GOSUB10034
3040 PCOPY4 TO 8
3050 RETURN
3100 REM TAKE OFF
3101 UC=1:BF=1:SP=0:HT=0:RP=0:HD=0:EF=0
3102 AA=50:REM AMMO
3110 HA=96:X1=0:X2=256
3120 GOSUB3000
3190 FORM=1 TO 4:PCOPY(M+4) TO M:NEXTM
3200 LINE(0,HA)-(256,HA),PSET
3210 LINE(X1,192)-(X2,HA),PSET
3220 LINE(160,HA)-(32,192),PSET
3225 IFUC=1 THEN FU=163 TO 170:PSET(U,192,8):NEXTU
3230 IFER=1 THEN LINE(128,96)-(128,144),
3231 BF=-BF:IFSF>=1 THEN LINE(128,96)-(128,144),PRESET
3300 SCREEN1,1
3310 IF INKEY$="S" THEN EF=1:GOTO3312
3311 IF EF=0 THEN GOTO 3310
3312 JD=JOYSTK(0):JD=JOYSTK(1):JP=JOYSTK(2)
3315 RP=2500-(30*JOYSTK(3))
3316 FU=FU-RP*35/(1800*1800)
3317 AY=AY-SP/720:IFAY<86 AND HT<10THEN CLS:PRINT "YOU RAN OVER THE END OF THE R
UNWAY":GOTO12000
3318 IFFU<=0 THEN RP=600
3319 SP=SP+(RP-1700)/200:IFSP<0 THEN SP=0:EF=0
3320 DE=400/(SP+1):FORD=1 TO DE:NEXTD
3330 PE=PEEK(65280):IFPE=125 OR PE=253 THEN HT=HT+10:GOSUB3000:HT=HT/10
3335 IFPE=126 OR PE=254 THEN GOSUB 6000
3340 IFUC=0 AND SP<80 AND HT<=2 THEN CLS:PRINT"YOU RETRACTED THE UNDERCARRIAGE",
"TOO SOON, AND CRASHED":GOTO12000
3400 REM TAKE OFF
3403 D#=INKEY$:IF D#="0" THEN UC=0
3405 IF SP>85 THEN BF=0:CANCEL FLASHING LINE
3410 IF BF=0 THEN 3420 ELSE 3900
3420 IFJD>42 THEN HA=HA+4:IFJD>52 THEN HA=HA+8
3425 IFJD<22 AND HT>10 THENHA=HA-4:IFJD<12 THEN HA=HA-8
3430 HT=HT-(96-HA)/8:IFHT<0 THEN HT=0
3432 IF HT<=2 AND SP<70 THEN BF=1
3435 IF HA<94 AND HT>0 THEN GOTO7030
3440 SP=SP-(HA-96)/10+(RP-1700)/100+2*(UC+1)
3460 IFSP<80 AND HT>10 THEN GOSUB4000
3465 IFSP<70 AND HT>10 THEN 5000:REM SPIN
3470 FORM=1 TO 4:PCOPY(M+4)TO M:NEXTM
3480 IF HA>192 THEN HA=192
3485 IFHA<0THEN HA=0
3490 IF HT<500 THEN GOTO 500
3500 IFSP>225 THEN GOTO 5500
3510 REM RESET X VALUES OF RUNWAY
3520 X1=96+HT/500:X2=256-(96+HT/500)
3900 GOTO3200
4000 SOUND100,5
4005 SP=SP+2
4010 RETURN
5000 REM SPIN & MAYBE RECOVER
5005 SC=0
5010 FORM=5 TO 8:FORD=1 TO 300:NEXTD:PCLS(N):NEXTN
5020 D=JOYSTK(0):IF JOYSTK(1)<4 AND HT>2000 THEN N=24:HA=8:SP=100:YF=0:YD=0:X0=0
: GOTO 500
5030 SC=SC+1:IFSC>4 THEN PCLS4:SCREEN0,0:CLS:PRINT@256, "YOU SPUN INTO THE GROUN
D":GOTO 12000
5040 GOTO 5010
5500 PCLS4:FOR D=1 TO 1200:NEXTD
5510 SCREEN 0,0:CLS:PRINT@256,"YOU EXCEEDED VNE":PRINT:PRINT"FLUTTER DEVELOPED":
PRINT:PRINT"AND THE WINGS FELL OFF"
5520 GOTO12000
5800 PCLS4:SCREEN0,0:CLS:PRINT@256,"YOU CRASHED INTO THE GROUND":PRINT:PRINT"AT
",(SP);" KNOTS":GOTO12000
6000 REM MAP
6005 IF HT<10 THEN RETURN
6010 PCLS
6015 IFAX<0 OR AX>256 ORAY<0 OR AY>192 THEN 6040
6020 LINE(124,84)-(132,106),PSET,B
6025 LINE(124,110)-(132,110),PRESET
6026 LINE(124,120)-(132,120),PSET
6030 LINE(AX-4,AY-4)-(AX+4,AY+4),PSET,BF
6035 LINE(108,182)-(148,192),PSET,B:LINE(108,182)-((108+FU),192),PSET,BF
6036 DRAW"BM110,170;S8"
6037 DRAW F#
6040 SCREEN1,1:FORD=1 TO 1500:NEXTD
6050 RETURN
6500 REM VNE WARNING
6510 SOUND200,5:SP=SP-2
6520 RETURN
6600 REM ENEMY A/C ATTACK
6610 IFAF=1 THEN 6652
6620 RX=RND(30):IF RX>29 THEN AF=1:ED=1000:SOUND50,2:LM=RND(2)
6630 IF AF=0 THEN RETURN
6640 EH=RND(80)-40
6650 EA=RND(72)-36:REM ENEMY ALTITUDE
6652 RE=RND(12):IF RE<12 THEN 6659:REM ALTER COURSE EVERY 12 TIMES
6655 RX=RND(10)
6659 IFRX=0 THEN 6700
6660 IFRX>7 THEN EH=EH+3
6665 IFRX<3 THEN EH=EH-3
6670 IFRX=9 THEN EA=EA+3
6675 IFRX=10 THEN EA=EA-3:REM ENEMY MOVEMENTS
6700 TH=HD:IF HD>180 THEN TH=HD-360
6710 EX=128+EH-TH
6720 YY=HA-96+
6730 EY=96+YY-EA
6740 DHED=(SP-160)*.375:IFED<80 THEN ED=80:REM ENEMY DISTANCE
6750 EL=2000/ED:EU=500/ED
6753 IF BF=1 THEN 6756
6755 RB=RND(10):CY=INT(ED/200):IFRB<10 THEN 6790
6756 IFEY>186 THEN EY=186
6757 IFEX<11 THEN EX=11
6758 IFEX>245 THEN EX=245
6759 IFEY<0 THEN EY=6
6760 BX(1)=EX-10:BY(1)=EY-5:BX(2)=EX+10:BY(2)=EY-5:BX(3)=EX-10:BY(3)=EY+5:BX(4)=
EX+10:BY(4)=EY+5:BF=1
6770 FORZ=1 TO 4:PSET(BX(Z),BY(Z),0):NEXTZ
6780 CY=CY-1:IFCY<1 THEN BF=0
6790 IF (EX-EL)<1 OR (EX+EL)>255 OR (EY-EU)<1 OR (EY+EU)>191 THEN 6999
6795 COLOR8,5
6800 LINE(EX-EL,EY)-((EX+EL),EY),PSET:LINE(EX,EY)-(EX,(EY-EU)),PSET:LINE((EX-E
U),(EY-EU))-((EX+EU),(EY-EU)),PSET
6805 COLOR8,5
6810 REM TEST FOR HIT ON YOUR PLANE
6815 IFCY<30 THEN 6999
6819 Z=1
6820 IF BX(Z)>124 AND BX(Z)<132 AND BY(Z)>92 AND BY(Z)<100 THEN GOTO 9200
6821 Z=Z+1:IFZ<5 THEN 6820
6999 RETURN
7000 REM LANDING
7010 IF AX>124 AND AX <132 AND AY >110 AND AY<120 AND ABS(HD-180)>150 AND HT<100
: THEN 7020 ELSE 998
```

(continued on page 91)

PROGRAM DIRECT DRAGON SOFTWARE



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(continued from page 89)

```
7020 HA=96:X1=112:X2=144:X3=96:X4=160:Y2=144:UC=0:FF=0:SS=70
7030 GOSUB3000
7100 JO=JOYSTK(0):JO=JOYSTK(1):RU=JOYSTK(2):JP=JOYSTK(3)
7110 IFJO>42THEN HA=HA+4:IFJO<52THEN HA=HA-4
7120 IFJO<22 THEN HA=HA-4:IFJO>12 THEN HA=HA-8
7130 IFHA>192 THEN HA=192
7140 IFHA<0 THEN HA=0
7150 HT=HT-(96-HA)/8:IFHT<0 THEN HT=0
7160 RP=2500-(30*JP)
7165 FU=FU-35*RP/(1800+1800)
7166 IF FU<=0 THEN RP=600
7170 VS=HA-96
7180 SP=SP-(HA-96)/10+(RP-1700)/100+2*(UC+1)+2*(FF+1)
7190 AY=AY-SP/720+COS(HD/57)
7200 PE=PEEK(65280):IFPE<125 OR PE>253 THEN HT=HT+10:GOSUB3000:HT=HT/10
7202 IF PE<128 OR PE>254 THEN GOSUB 6000
7205 Q=INKEY$
7210 IF Q$="B" AND SP<120 THEN UC=1
7215 IF Q$="F" AND SP<140 THEN FF=1:SS=60
7216 IF Q$="D" THEN 500
7217 Q$=""
7220 IFSP<80 THEN GOSUB 4000: IF SP<55 THEN GOTO 5000
7225 IFSP>(VN-7) THEN GOSUB6500
7230 IF SP>VN THEN GOTO5500
7240 IF UC=1 THEN FOR U=163 TO 170:PSET(U,192,8):NEXTU
7245 IF FF=1 THEN FOR U=50 TO 56:PSET(U,192,8):NEXTU
7250 X1=128-32*(500/(HT+1)):IFX1<96 THEN X1=96
7260 X2=128+32*(500/(HT+1)):IFX2>160 THEN X2=160
7270 X3=128-48*(500/(HT+1)): IF HT>500 THEN X3=80+HT/500
7280 X4=128+48*(500/(HT+1)):IFHT<500 THEN X4=256-(80+HT/500)
7282 HD=HD+(RU-32)/4:IFHD>0 THEN HD=HD-360
7285 IFHD>360 THEN HD=HD-360
7295 AX=AX+SP/720*SIN(HD/57)
7296 DS=SQR((128-AX)
7300 X1=X1+DS:X2=X2+DS:X3=X3+DS:X4=X4+DS
7310 IFX1<0 OR X2<0 OR X3<0 OR X4<0 THEN 7630
7320 IFX1>255 AND X2<-15 THEN HT=HT-VS
7326 GOTO7100
7630 IFUC=0 THEN SCREEN0,0:CLS:PRINT "IDIOT! YOU LANDED WITH THE WHEELS UP!":STO
P
7640 PCLS:GF=1
7650 REM ON GROUND
7660 LINE(0,96)-(256,96),PSET
7670 LINE(96,96)-(0,192),PSET
7680 LINE(160,96)-(256,192),PSET
7690 IFGF=1 THEN LINE(128,96)-(128,144),PSET
7700 IFGF=-1 THEN LINE(128,96)-(128,144),PRESET
7710 GF=-GF
7720 X1=500/(SP+1):FORD=1 TO DE:NEXTD
7730 SCREEN1,1
7740 IFPE<125 OR PE>253 THEN HT=HT+10:GOSUB 3000:HT=HT/10
7742 IF PE<128 OR PE>254 THEN GOSUB 6000
7745 PCOPY0 TO 4
7750 FORJ=0 TO 3:JO=JOYSTK(J):NEXTJ:RP=2500-(30*JO):FU=FU-35*RP/(1800+1800):IF F
UC=0 THEN RP=600
7751 SP=SP-(RP-1700)/200
7760 IFSP<0 THEN SCREEN0,0:CLS:PRINT"SAFE LANDING":GOTO12000
7765 IFAX<127 OR AX>129 THEN SCREEN0,0:CLS:PRINT"YOU RAN OVER THE EDGE OF ","THE
 RUNWAY":GOTO12000
7770 AY=AY-SP/720:IFAY<8A THEN SCREEN0,0:CLS:PRINT"YOU RAN OVER THE END OF THE R
UNWAY":GOTO12000
7780 GOTO7650
8500 REM FIRE ROUTINE
8505 IFAM<1 THEN 8999
8510 SOUND1,1:AM=AM-1
8520 IFPOINT(128,96)<>6 AND POINT(128,95)<>6 AND POINT(128,97)<>6 THEN 8999
8522 EXEC32368:REM M/C EXPLOSION
8523 FORD=1 TO 400:NEXT
8524 LM=LM-1:IFLM>0 THEN 8999
8525 SCREEN0,0:CLS
8530 ES=ES+1
8540 PRINT"SCORE ";ES,"AMMO ";AM:FORD=1 TO 2000:NEXTD
8550 AF=0:SCREEN1,1:PCLS
8999 PE=0:RETURN
9000 REM INSTRUCTIONS
9005 CLS
9010 PRINT"please";CHR$(128);"read";CHR$(128);"the";CHR$(128);"instructions";PRI
NT"while";CHR$(128);CHR$(105);CHR$(128);CHR$(97);CHR$(109);CHR$(128);"initialis
ng"
9020 PRINT:PRINT"LH JOYSTICK CONTROLS","THROTTLE AND RUDDER","WHILE THE BUTTON U
PDATES","THE DIALS"
9030 PRINT:PRINT"RH JOYSTICK CONTROLS PITCH","AND ROLL WHILE THE BUTTON","GIVES
A MAP AND FUEL GAUGE"
9040 PRINT:PRINT"YOUR STALLING SPEED IS 70","AND VNE IS 240"
9100 RETURN
9200 REM YOU ARE HIT
9205 FOR D=1 TO 4:EXEC32400:NEXT D:REM WOBBLE
9210 LV=LV-1:IF LV<1 THEN 9400:'LIVES
9215 CY=-1:SOUND240,3
9220 RD=RND(3):ON RG GOTO 9230,9280,9330
9230 SCREEN0,0:CLS:PRINT"FUEL TANK HOLED":FU=FU-10
9240 FORD=1 TO 2000:NEXT:SCREEN1,1:GOTO6999
9280 SCREEN0,0:CLS:PRINT"OIL FEED HIT","ENGINE REVS REDUCED BY 500":MR=MR-500
9290 FORD=1 TO 2000:NEXT:SCREEN1,1:GOTO6999
9330 SCREEN0,0:CLS:PRINT"AIRFRAME DAMAGED","VNE REDUCED BY 40KT.":VN=VN-40:SP=SP
-40
9340 FORD=1 TO 2000:NEXT:SCREEN1,1:GOTO6999
9400 SCREEN0,0:CLS:PRINT"BALE OUT!"
9410 FOR D=1 TO 2000:NEXT
9420 REM CRASH ROUTINE HERE
9422 SCREEN1,1
9425 FOR H=96 TO 0 STEP -12:FORZ=1 TO 4:PCOPY(Z+4) TO Z:NEXTZ
9426 LINE(0,H)-(256,H),PSET
9427 POKE32766,4*(H+3)-32/256:POKE32767,127:POKE32762,24:POKE32763,31:EXEC32303
9428 NEXTHA
9429 FORZ=1 TO 4:PCOPY(Z+4) TO Z:NEXT:POKE32766,6:POKE32767,127:POKE32762,24:POK
E32763,31:EXEC32303
9430 FORZ=1 TO 255 STEP 2:SOUNDZ,1:NEXT
9434 PCLS:FOR D=1 TO 12
9435 FORZ=0 TO 3:DRAW"A"+STR$(Z):PCLS
9440 DRAW"BM0,0;F250;BL250;E250"
9445 PCLS8
9450 NEXTZ,D
9455 DRAW"A"+STR$(0)
9460 PCLS
9500 DATA70,65,190,65,70,65,125,185,190,65,135,185,105,65,130,185,130,65,130,185
,155,65,130,185,110,177,150,177,110,180,125,180,135,180,150,180,125,177,125,192,
135,177,135,192,125,185,135,185,125,180,135,180
9560 FORI=1 TO 13:READX,Y,A,B:LINEX,Y-(A,B),PSET:NEXT
9615 RESTORE
9620 CIRCLE(130,130),90,8,1,.64,.88
9630 CIRCLE(130,165),5
9640 CIRCLE(107,177),5
9650 CIRCLE(153,177),5
9700 FORD=1 TO 5000:NEXT
9710 CLS:GOTO12000
```

```
9999 GOTO9999
10000 REM STRINGS
10010 A#(1)="BD1E1R1F1D2NF1G1L1H1E1R1F1BR3BU3";'A
10011 A#(2)="BR1NR2D1F1R1F1L2D1L2BR5BU4";'B
10012 A#(3)="ND4BU1U1E1R2D1F1";'C
10013 A#(4)="D4U2E1R1F1BR2BU1";'R
10014 A#(5)="D4ND2R2E1U2H1L2BR5";'P
10016 A#(6)="D4U3E1F1ND3E1F1D3BR1BU4";'M
10017 A#(7)=A#(1);'A
10018 A#(8)="NU2D3F1E1R2BU3";'L
10019 A#(9)="R1NUNR2D3F1E1BR7BU3";'T
10020 A#(10)="BD1E1R1F1ND3D2E1L1H1U2BR4BU1";'O
10021 A#(11)="BD1E1D4L1R2BR1BU4";'I
10022 A#(12)="BD1E1R1F1D1G2L1R3BR1BU4";'2
10023 A#(13)="BD1E1R2F1D1N.2F1G1L2H1BU3BR4";'3
10024 A#(14)="BD2E2D2NH1ND2L2BU2BR4";'4
10025 A#(15)="NR3D2R2F1G1L2BR4BU4";'5
10026 A#(16)="BD1E1R2BL2BG1D2F1R1E1H1L2BR4BU2";'6
10027 A#(17)="R3D1D3BR4BU4";'7
10028 A#(18)="BR1R2F1G1L2H1NE1F1G1F1R2E1H1BR2BU2";'8
10029 A#(19)="BR4F1R1F1D2G1L2BU3NE1F1R1E1H1BU1";'9
10030 A#(20)="NU2D4U3E1R1F1D3BR1BU4";'H
10031 A#(21)="BR3NU2D4L2H1U1NE1D1F1R3D2G1L2";'G
10032 A#(22)="BR1R2F1D1G1L2H1U1NE1D1F1R3D2G1L2";'G
10034 B#="";C#="";
10035 FORC=1 TO 9:B#=B#+A#(C):NEXTC
10036 FORC=20 TO 22:C#=C#+A#(C):NEXTC
10037 A#(23)="BD1E1R1F1BD2BL1D4BU4BR3";A#(24)="D3F1R1E1NF1U3BR2";A#(25)="BR1R
2F1D1L4U1NE1D2F1R2E1BU3BR2";REM F,U,E
10038 F#=A#(23):A#(24)=A#(25):A#(8)
10040 DRAW"BM12,156;S8"
10050 DRAW8#
10060 DRAW"BM196,156"
10070 DRAW4#
10080 DRAW "BM52,184;S4"
10085 DRAW A#(23)
10090 DRAW"BM164,182;S4"
10095 DRAW A#(22)
10100 RETURN
12000 PRINT:PRINT"A) TO FLY AGAIN"
12010 IF INKEY$="A" THEN SP=100:HA=96:HT=3000:AY=96:AX=128:FU=40:VN=240:MR=2500:
LV=RND(3)+8:GOTO420
12020 GOTO12010
```

Alterations for keyboard option.

```
10 HA=96:YP=0:YD=0:JO=0:ES=0:RA=50:VN=240:MR=2500:LV=RND(3)+8:U=30
435 CLS :PRINT"IN THIS VERSION, X WILL SHOOT";"HT THE ENEMY AIRCRAFT"
445 IFQ$="X" THEN HT=999 ND=0:SP=100:FOR128:FOR115:FOR200:SP=128:GOTO7420
506 Q$=INKEY$
510 IFQ$=CHR$(3) THEN N=N+1
520 IF Q$=CHR$(8) THEN HH=1
820 IFQ$=CHR$(94) THEN HH=HH-V
825 IFQ$=CHR$(18) THEN HH=HH+V
915 IFQ$="P" THEN RU=32
916 IF Q$="S" THEN RU=5C
917 IF Q$="I" THEN RP=RP + 100
918 IF Q$="O" THEN RP=RP-100
919 IFRP<600 THEN RP=600
920 IFRP>MR THEN RP=MR
975 IF Q$="X" THEN GOSUB6500
980 IFQ$="Q" THEN GOSUB 6000
991 Q$="" RU=32
3105 RP=2200
3205 Q$=INKEY$
3310 IF INKEY$="S" THEN EF=1:GOTO3315
3314 IFQ$="D" THEN RP=RP-100:IF RP<600 THEN RP=600
3315 IFQ$="I" THEN RP=RP+100:IF RP>2500 THEN RP=2500
3330 IFQ$="O" THEN HT=HT+10:GOSUB3000:HT=HT/10
3335 IFQ$="M" THEN GOSUB6000
3403 IF Q$="Q" THEN UC=0
3420 IFQ$=CHR$(10) THEN HH=HH+8
3425 IFQ$=CHR$(94) THEN HH=HH-8
3830 Q$=""
5020 IF INKEY$=CHR$(94) AND HT>2000 THEN N=24:HH=8:SP=100:YP=0:YD=0:JO=0:U=30
7100 Q$=INKEY$ RU=32
7101 IFQ$="P" THEN RU=20
7102 IFQ$="S" THEN RU=44
7110 IFQ$=CHR$(10) THEN HH=HH+4
7120 IFQ$=CHR$(94) THEN HH=HH-4
7160 IFQ$="O" THEN RP=RP-100:IF RP<600 THEN RP=600
7161 IFQ$="I" THEN RP=RP+100:IF RP>2500 THEN RP=2500
7200 IFQ$="Q" THEN HT=HT+10:GOSUB3000:HT=HT/10
7202 IFQ$="M" THEN GOSUB6000
7217 Q$=""
7655 Q$=INKEY$
7740 IFQ$="O" THEN HT=HT+10:GOSUB3000:HT=HT/10
7742 IFQ$="M" THEN GOSUB6000
7748 IFQ$="I" THEN RP=RP+100:IF RP>MR THEN RP=MR
7749 IFQ$="D" THEN RP=RP-100:IFRP<600 THEN RP=600
7750 IF FU<1 THEN RP=600
7775 Q$=""
9020 PRINT:PRINT"I & O CONTROL ENGINE","P & S GIVE RUDDER CONTROL","HH:U UH
S INSTRUMENTS"
9030 PRINT:PRINT"RP=CN KEYS CONTROL ROLL","HH PITCH, WHILE M GIVES RMP","HH:
EL GAUGE"
12010 IF INKEY$="R" THEN SP=100:HA=96:HT=3000:AY=96:AX=128:FU=40:VN=240:MR=25
LV=RND(3)+8:GOTO420
DELETE THESE LINES: 826, 847, 976, 9312, 7205.

7160 IF Q$="I" THEN RP=RP+100:IF RP>MR THEN RP=MR
will deny you maximum revs when landing after oil feed damage.
```

Decimal listing of machine-code routines.

```
32256 204   0   0  253 127  252 204   0  96  243
32266 127  254  16  179 127  250  36  28  253 127
32276 254  190 127  254  198   1  166 132  129   0
32286 38  224  231  128  124  127  252  246  127  252
32296 193   32  39  212   32  234  57  204   0   0
32306 253  127  252  204   0  96  243  127  254  16
32316 179  127  250  36  30  253  127  254  190  127
32326 254  198   1  166  132  129   0  38  224  231
32336 132  166  130  124  127  252  246  127  252  193
32346 32  39  210  32  232  57   0   0   0   0
32356 0   0   0   0   0   0   0   0   0   0
32366 0   0  16  142  16  207  142  127  96  166
32376 128  167  160  166  128  167  160  166  128  167
32386 160  49  168  30  15  140  19  46  36  2
32396 32  233  57   0  142  24   0  16  142  25
32406 0  166  160  167  128  16  140  30   0  36
32416 2  32  244  142  29   0  16  142  30   0
32426 166  130  167  162  140  24   0  35  2  32
32436 245  57  57   0   0   0   0   0   0   0
```

Machine-code explosion data.

```
32600 192  192  192  192  192  192   0  192   0   0
32610 192   0   0  192   0   0  12  204   0  12  204
32620 0   3  240   0   3  240   0  255  255  192
32630 3  240   0   3  240   0  12  204   0  12
32640 204   0   0  192   0   0  192   0   0  192
32650 0  192  192  192  192  192  192   0   0   0
```

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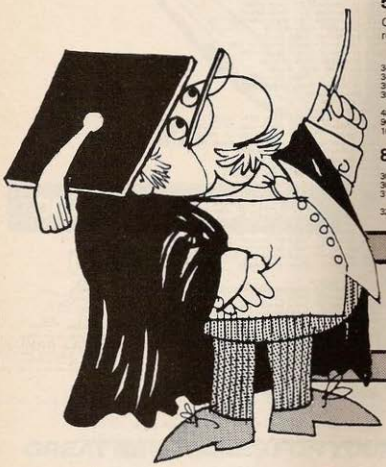

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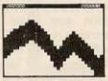

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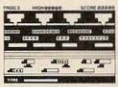

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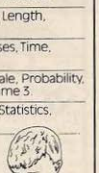

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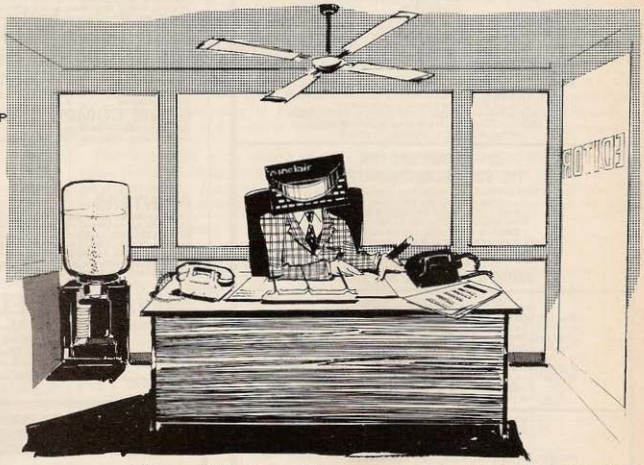
EDITOR

```
100 PRINT "List From"
110 GO SUB 8100
120 LET a=x
130 GO SUB 8000
140 PRINT x$;" ";
150 FOR j=1 TO 4
160 LET x=PEEK a
170 GO SUB 8050
180 PRINT x$;" ";
190 LET a=a+1
200 NEXT j
210 PRINT
220 GO TO 130
300 PRINT "Write To"
310 GO SUB 8100
320 LET a=x
340 LET x=a
350 GO SUB 8000
360 PRINT x$;" ";
370 INPUT a$
380 IF a$="S" THEN STOP
390 IF LEN a$<>2*INT
    (LEN a$/2) THEN
    GO TO 370
400 PRINT a$
410 LET x$=a$( TO 2)
420 GO SUB 8120
430 POKE a,x
440 LET a=a+1
450 LET a$=a$(3 TO )
460 IF a$>"" THEN GO
    TO 410
470 GO TO 340
500 PRINT "Run From"
510 GO SUB 8100
520 CLS
530 LET A=USR x
540 STOP
8000 LET x=INT (a/256)
8010 LET z=x
8020 GO SUB 8050
8030 LET x=a-z*256
8040 GO TO 8060
8050 LET x$=""
8060 LET k=INT (x/16): LET
     y=k: IF y>9 THEN LET
     y=y+7
8070 LET x$=x$+CHR$ (y+48)
8075 LET k=x-k*16: IF k>9
     THEN LET k=k+7:
8080 LET x$=x$+CHR$ (k+48)
8090 RETURN
8100 INPUT x$
8110 IF LEN x$<>4 THEN GO
     TO 8100
8120 LET x=0
8130 FOR i=1 TO LEN x$
8135 LET y=CODE x$(i): IF
     y>57 THEN LET y=y-7
8140 LET x=x*16+y-48
8150 NEXT i
8160 RETURN
```

Figure 1. Hexadecimal loader



Trevor Hill dons his green eyeshade and presents a program which stops you making wrong inputs to your Spectrum

THIS EDITOR program provides a user-friendly set of routines that will protect against invalid input as far as possible. The routines have been located at the top end of RAM, just below the space reserved for user-defined graphics. Consequently other programs on which you wish to use the routines may be loaded in the normal manner. The listing is for a 16K Spectrum but details to relocate the code for a 48K model are included later in the article. The Basic program is as program 1.

To enter the menu Run 9999. The first 11 routines occupy just under 3K of memory and you will see that provision has been made for a further five routines. A particular routine is called by input of the appropriate routine number. Should you accidentally call up one of the last five routines the program will default to routine 00.

Whenever input is required a prompt message is displayed followed by a flashing question mark. Any time that input is being requested the routine may be terminated by use of Break — Shift Space. Should you make a typing error it may be corrected by use of Delete — Shift 0. Once input is complete the flashing question mark remains until you confirm input by Enter.

In order to illustrate the use of routine 00, which is a disassembler, you are asked for the start and finish addresses and print details. The routine knows that addresses must be in hexadecimal and will only accept input of the correct length. Should you type in a finish address lower than the start address the routine will be aborted. Input 11 in order to dump to the printer — any other input will dump to the screen. As in Basic screen full will give the Scroll message. N will terminate the routine, almost any other key will cause the display to continue.

The disassembler handles correctly all Z-80 instructions and recognises that RST 08 and RST 28 instructions are followed by data bytes. Since labels are not included, JR instructions give as part of the mnemonic the absolute jump address.

Routine 01, the Print Data routine, is similar to routine 00 except that Output is now Data. In figure 5, routine 02 will interpret the bytes as character codes. Codes 00 to 1F do not represent characters and a flashing question mark will be printed whenever the routine comes across one of these codes.

Routine 03 — Write Code — allows the input of instructions or data. It is intended that each line of input should correspond to one instruction so the maximum number of bytes that will be accepted is four. The program knows that each byte occupies two hex digits, so it will not accept an odd number of digits. Exit from this routine is by Break.

Routine 04 — Write Chr$ — is similar to routine 03 except the input now represents characters. Numbers, upper and lower case letters and the symbols in red on the keys — function shift — may be input. I have excluded the keywords written on the keys and symbols <=, <>, >= since the use of the delete key

(continued on page 97)

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(continued from page 95)

would mess up the display; these, and the other keywords, will have to be input using their character codes and routines 03.

Routine 05 — Insert — enables the insertion of code. The present limit is the highest address to which code has been written. You will see that an opportunity is given to change the limit value. As code is input, room is made for it by moving up the existing code between the write address and limit address. Figure 15 shows the effect of the input given in figure 8; exit from the routine is by Break.

Routine 06 — Delete — deletes code from Start address to Finish address. The purpose of the Limit address is as described for routine 5. This time, code is removed by moving the code after Finish address down memory to Limit address. The byte immediately after Finish address will end up in Start address and so on. In both routines 05 and 06 if the relationship between Start, Finish and Limit addresses does not make sense then the routine will be aborted.

Routine 07 — Move routine — transfers a block of code to some other location. The transfer may be up or down memory, the routine will sort out the details. The code in Start address is moved to Move address, the code is Start address +1 to Move address +1 and so on. If the move is down memory the limit address remains unchanged but can be changed by using routine 05 (exit from routine 05 after changing limit). If the move is up memory then the limit address is updated automatically.

Routine 08 called Search enables a block of memory to be searched for a particular sequence of code. The search code may be from one to eight bytes in length. This routine is particularly useful if you are thinking of modifying a sub-routine and you wish to know exactly where in the program it is being called. The addresses listed are where the start of the code occurs. Screen full will give the opportunity to Scroll. Routine 09 — Replace — enables a block of memory to be searched for a particular sequence of code and wherever it is found, replaced. The code may be from one to eight bytes in length and once the search length is decided the routine will only accept a replacement code of the same length. This routine will be particularly useful later for modifying the program for the 48K Spectrum.

Routine OA — the Run routine — is used to run other machine-code programs. If break points are not required then input an address in ROM as the break point — say 0000. This, of course, will have no effect. The left hand registers are the main set and the right hand registers the alternative set. You now have the option of either: continuing to run from the break point with no further breaks — type in a ROM address; continuing to run with a further break point; or aborting the routine by Break.

There is no limit to the number of break points you use, so single stepping through a program is possible. Just keep on changing the break point by one instruction at a time. One word of warning — when a break point is inserted in a program it actually changes the program by inserting a JP instruction. As long as you hit the break point the program will be automatically returned to its original value. If for some reason the break point is not reached you will have to correct the program manually.

Some possibilities for additional routines that spring to mind are an assembler, user-defined graphics generator, hex/octal/binary/decimal conversion routines, two-pass disassembler — but I must move on to something else.

Table 1 includes the locations where you should store the addresses of your routines. To modify the menu to display your routine titles only requires the addition of data starting at 7E86. The menu details start at 7E00 and consist of the character code corresponding to the routine names. The end of a message is signified by having bit 7 set.

I have included the first few bytes in table 2 and if you carry on you should see what modifications to make from 7E86 onwards.

(continued on next page)

Table 1. Variables.

				Routine addresses						
Address	Contents	Address	Contents	Address	Contents			Address	Contents	
7F00	Variable	7F28	Break	7F38	00	6C		7F48	08	EE
	string	7F29	Point	7F39		77		7F49		76
		7F2A	code	7F3A	01	8E		7F4A	09	AE
		7F2B	C3	7F3B		79		7F4B		76
		7F2C	CF	7F3C	02	7C		7F4C	0A	95
		7F2D	73	7F3D		75		7F4D		73
		7F2E	Limit	7F3E	03	52		7F4E	0B	
7F1F		7F2F	address	7F3F		77		7F4F		
7F20		7F30	Transfer	7F40	04	B7		7F50	0C	
7F21		7F31	address	7F41		75		7F51		
7F22		7F32	Finish	7F42	05	34		7F52	0D	
7F23		7F33	address	7F43		76		7F53		
7F24		7F34	Start	7F44	06	09		7F54	0E	
7F25		7F35	address	7F45		76		7F55		
7F26		7F36	String	7F46	07	37		7F56	0F	
7F27		7F37	address	7F47		75		7F57		

Table 3. 48K Changes made using replace routine.

16K	48K	16K	48K	16K	48K	16K	48K
CD887A	CD88FA	C3A173	C3A1F3	CD857A	CD85FA	267D	26FD
CD987A	CD98FA	CDE474	CDE4F4	21FC7C	21FCFC	2678	26F8
CDA57A	CDA5FA	CDEE74	CDEEF4	216677	2166F7	21007E	2100FE
CDAD7A	CDADFA	CDF974	CDF9F4	DA4176	DA41F6	218C79	218CF9
CDBB7A	CDBBFA	CD0475	CD04F5	2A2E7F	2A2EFF	267F	26FF
CDC57A	CDC5FA	CD2375	CD23F5	ED632E7F	EC532EFF	21107E	2110FE
CDC97A	CDC9FA	CDE075	CDE0F5	DAFD76	DAFDF6	21DF79	21DFF9
CDCA7A	CDCAFA	CD6B76	CD6BF6	21367F	2136FF	21007F	2100FF
CDE07A	CDE0FA	CD1F77	CD1FF7	ED5B347F	ED5B34FF	11357F	1135FF
CDF07A	CDF0FA	CD3377	CD33F7	222E7F	222EFF	ED5B367F	ED5B36FF
CDFA7A	CDFAFA	CD4277	CD42F7	21B77E	21B7FE	ED53367F	ED5336FF
CD257B	CD25FB	CD8278	CD82F8	112F7F	112FFF	210F7B	210FFB
CD3B7B	CD3BFB	CD9B7A	CD9BFA	212F75	212FF5	267E	26FE
CDB57B	CDB5FB	CD9378	CD93F8	21317S	2131F5	C3FD76	C3FDF6
CDB77B	CDB7FB	CDB478	CDB4F8	11187F	1118FF	ED5B2E7F	ED5B2EFF
CDC07B	CDC0FB	CDF578	CDF5F8	21187F	2118FF	212F7A	212FFA
213375	2133F5	CDD478	CDD4F8	ED53347F	ED5334FF	CDDC78	CDDCF8
11287F	1128FF	CDBF79	CDBFF9	11107F	1110FF	267C	26FC
22307F	2230FF	CDC279	CDC2F9	212D7A	212DFA	212479	2124F9
2A347F	2A34FF	CDE179	CDE1F9	21097D	2109FD	213575	2135F5
2A207F	2A20FF	CDE479	CDE4F9	32367F	3236FF	CD747A	CD74FA
ED73307F	ED7330FF	CDE879	CDE8F9	21F67C	21F6FC	22347F	2234FF
21287F	2128FF	CDEC79	CDECF9	320B7D	320BFD	CD6B7A	CD6BFA
ED5B327F	ED5B32FF	CDFF79	CDFFF9	210A7D	210AFD	22367F	2236FF
21B17E	21B1FE	CD027A	CD02FA	21167D	2116FD	2A327F	2A32FF
11337F	1133FF	CD157A	CD15FA	21FE7C	21FEFC	CD5B7A	CD5BFA
21DF7B	21DFFB	CD1C7A	CD1CFA	C3C97A	C3C9FA	2A367F	2A36FF
ED5B307F	ED5B30FF	CD317A	CD31FA	21FD7D	21FDFD		
212A75	212AF5	CD367A	CD36FA	21FE78	21FEF8		

Table 2. Print Data

Address	Byte	CHR$	Address	Byte	CHR$
7E00	20		7F00	30	O
7E01	20		7F01	30	O
7E02	20		7F02	20	
7E03	20		7F03	50	P
7E04	4D	M	7F04	52	R
7E05	45	E	7F05	49	I
7E06	4E	N	7F06	4E	N
7E07	D5	U	7F07	54	T
7E08	20		7F08	20	
7E09	20		7F09	43	C
7E0A	20		7F0A	4F	O
7E0B	20		7F0B	44	D
7E0C	3D	=	7F0C	C5	E
7E0D	3D	=	7F0D	30	0
7E0E	3D	=	7F0E	31	1
7E0F	BD	=	7F0F	20	

Table 4. 48K Changes Using Write Code Routine

Address	Byte	Address	Byte
FF2D	F3	FF47	F5
FF37	FF	FF49	F6
FF39	F7	FF4B	F6
FF3B	F9	FF4D	F3
FF3D	F5	FF4F	F7
FF3F	F7	FF51	F7
FF41	F5	FF53	F7
FF43	F6	FF55	F7
FF45	F6	FF57	F7

(continued from previous page)

You will also of course have to amend the Basic program to make more memory available above RAMtop. If you decide to have a go at understanding how the program works I would suggest you leave the disassembler till last since it does call a couple of complicated routines. In fact the Add String routines can call themselves up to twice and it is possible to lose track of what is going on myself. The machine stacks start to look a bit like Clapham Junction.

I keep details of the routines on flow charts and if any one would like a set I am quite prepared to provide them. But please enclose £1 to cover the cost of photocopying, postage and overdraft.

Now for the modifications to convert for the 48K model. Use routine 07 — Move — to locate a copy of the 16K program at the top of RAM. The Start address is F395, Finish address FF57.

Use routine 09 — Replace — to change the Call, JP, JR and absolute addressing instructions. In each case start address is F395, finish address FBDE, search code as in the 16K column of table 3, replace code as in the 48K column. Next, use routine 03 — Write code — to change the bytes indicated in table 4. Now, modify the Basic listing. Save a copy of the program using Run 9997.

To test the 48K version switch the Spectrum off and then on, and Load. If all is well Run 9999 should take you from menu.

The 48K version does have one idiosyncracy — that is a posh way of avoiding the word bug. Some of the routines detect that they have finished by comparing the next address with the Finish address. The routines actually subtract the next address from the Finish address and Return if a Carry is generated. In the 16K version this is acceptable since the largest address you will need is 7FFF and when the Start address reaches 8000 the Carry is produced.

In the 48K version, however, the largest address now possible is FFFF and so we have to change the start address moves from FFFF to 010000. But of course the Z-80 only uses two bytes for addresses, therefore the Start address actually changes to 0000 and a Carry will not be generated. So be warned — if your Finish address is FFFF then some of the routines will never terminate.

If this feature of the program upsets you then the routine you will need to modify is at 79E1 to 79EB.

If anyone intends to modify the ZX-81 version of this program to work in a 64K model then the same problem exists. The routine on the ZX-81 that will require modification is at 7B81 to 7B8B.

Figure 1 lists a how reset routine. Run 100 to list code, Run 200 to list code and run 500 to execute code. Run 9997 to save. The loader is intended to work with Caps Lock On. Terminate Write by inputting S.

To enter the machine code type in the hex loader in figure 1 and then Run 300. When the program gives the prompt "write to" type the start address in hex, 73F5, and press Return. You can now enter the code either in blocks or an instruction at a time. After entering the instruction at address 7E00 type S to stop, rerun the program and the two further sections of code at 7F2B and 7F36.

Finally, if you are interested in the program but do not want to type in such lengthy code, then I can supply a tape for £3 plus 50p postage[1] and packing from the following address — 1 Highcroft Close, Yardley Gobion, Northamptonshire. ■

Program 1.

```
9996 STOP
9997 SAVE "editor" LINE 9998: SAVE
"editor"CODE 29589,3011: STOP
9998 CLEAR 29588: LOAD "editor"CODE:
STOP
9999 RANDOMISE USR 31019
```

Figure 2. Main program

```
73F5 7F 01 03 00 ED B0 CD 6B 7635 01 CD 6B 76 2A 2E 7F CD 7875 92 78 23 23 CB BE 2B 2B
73F8 00 7F CD 02 B6 21 1E 7E 763D E4 79 30 20 2A 2E 7F 23 7878 2B 2B 36 00 02 C6 97 77 F9 FC
7405 CD C5 7A 2E E3 CD C9 7A 7645 CF 05 23 FD 36 76 05 E5 7880 C9 98 7A CB FE CD 98 7A
7408 2A 36 76 06 CD E5 CD 7A 764D CD FF 79 21 36 7F 36 CB 7888 C9 78 FE 01 20 10 CD E0
7411 29 DF 11 23 7F CD B8 7A 7655 3D 26 00 CD B8 2E 7F 19 7890 75 21 FD 7D CD C5 7A CD
7414 3E 06 07 3E 00 B7 21 DF 7658 22 2E 7F EB C1 C5 ED B8 7898 85 7A CD 98 7A C9 FE 05
7427 78 CD C5 7A CD 7D 36 76 00 765D 15 FD E1 18 E1 21 DF 78A0 3B CB CD B4 78 18 F7 00
742D CD E0 75 FD 36 76 03 CD 7660 77 CD 31 7A 21 B7 7E CD 78A8 20 EB 0E 04 CD E0 75 18
7435 E0 75 CD C5 7A FD 36 76 7665 C5 7A 2E F2 CD C9 7A FD 78B0 DE CB 40 20 11 CD D4 78
743D 00 CD E0 75 C1 CD C4 75 766D 36 76 00 CD E0 75 3E 20 78B8 13 C9 3E 01 CB 40 20 1E
7445 FD 36 76 01 CD E0 75 C1 7675 D7 11 2F 7F CD BB 7A 3E 78C0 18 05 CB 40 28 0F 13 AF
744D C4 75 3E 00 CD B7 2E 00 7678 00 D7 3E 00 D7 21 2F 75 78C8 18 14 CB 40 28 07 13 78
7450 7A 3E 0D D7 06 03 D1 CD 767D C2 79 FD CB 01 4E FD 78D0 CB 87 0F 18 09 CD BC 78
7455 EE 7A 78 CD F9 74 D1 CD 7685 C9 01 11 2F 7F CD 36 2A 78D8 13 C9 78 18 01 79 13 62
745D E4 7A 78 CD F9 74 3E 00 7688 C9 CD 1F 77 3E 0F A3 4F 78E0 6B 6E 26 7C CD C9 7A C9
7475 D7 CD BB 3E 00 D7 06 02 7690 CD 21 2F 7A 11 18 7F 78E8 1A F5 E6 07 21 FE 78 18
747D 06 07 3E 20 D7 18 FB D1 7698 FD 36 76 0C CB CD 33 77 78F0 1E F1 F5 CB 77 28 00 2A
7485 CD EE 74 78 CD F9 74 3E 76A0 C1 CB 09 CD E1 79 38 2D 78F8 3A 7F CB 55 36 20 23 28
748D 0F D7 20 E0 CD 00 00 00 76A8 CD 62 77 20 13 21 18 7F 7900 DE CB 40 20 11 CB D4 78
7495 00 06 07 3E 20 D7 10 FB 76B0 ED 5B 34 7F 06 00 C5 ED 7908 C0 CB 28 0B 21 24 79 E5
749D ED 5B 30 7F CD EE 74 7B 76B8 B0 C1 ED 53 34 7F 18 E5 7910 26 7D 6F 66 26 7D E9 F1
74A0 CD F9 74 3E 00 D7 3E 00 76C0 2A 34 7F 23 22 34 7F 18 7918 2D 2C 20 0A 7E 23 5E 56 2B
74A8 D7 06 05 3E 20 D7 10 FB 76C8 DA CD 1F 77 3E 0F A3 4F 7920 0D FD CB 02 B6 FD 36 76
74B0 2A 30 7F 5E 23 56 21 2A 76D0 7B 78 B1 20 0D 3E 0A D7 7928 0D 20 10 01 21 00 7F 7E
74B8 75 CD EE 74 7B CD F9 74 76D8 FD CB 30 9E C9 CD 42 77 7930 06 12 CD C5 7A CD E0 75
74C0 3E 0D D7 3E 00 D7 2A 32 7700 20 0F E5 CD 85 7A E1 06 7938 10 FB 3E 0D D7 FD 36 76
74C8 72 2A 34 7F 21 B8 79 2E 7708 05 20 20 ED 10 FA 2A 34 7940 0D 20 0D 3E 0A D7 CD 25
74D0 04 01 FD CB 30 DE 11 33 7710 7F 2A 34 7F 23 22 34 7F 7948 7B 28 2B 3E 30 BE 20 CE
74D8 7F CD 3A 79 C5 E3 75 FE 7718 13 DE 06 02 21 1E 7E 7950 7B 28 2B 7A A7 20 3B 2B
74E0 36 76 01 CD E0 75 7A 18 7720 31 7A 11 10 7F 21 2D 7A 7958 6F 26 7F 7E 23 66 6F E5
74E8 0B CD C5 7A FD 36 76 00 7728 0E 10 FD 36 76 04 05 CD 7960 C5 CD 6B 00 CD CB 02 B6
74F0 E0 75 7A CD E5 E3 21 FC 7730 7A 20 F8 CD 7D 7A 21 2D 7968 7D 4F 32 5A 7F 79 21 10
74F8 7C CD A5 7A E1 C1 C9 CD 7738 D1 CD 74 7A C9 41 11 10 7970 7E CD CA 7A FD 36 76 02
7500 79 CD 23 75 CB 71 CD 23 7740 7A 2A 34 7F 1A BE 00 FD 7978 CD E0 75 3E 0D D7 C9 FB
7508 21 A1 CD 23 75 CB 71 CD 7748 CB 13 23 18 F7 06 01 21 7980 CD 7A 2A 34 7F 1A BE 00
7510 CB 23 75 CB 49 CD 23 75 7750 66 77 CD 31 7A FD CB 76 7988 7A CD BF 79 CD E1 79 30
7518 CB 41 CD 23 75 C9 3E 30 7758 FD 36 76 FF C9 CD 15 7A 7990 49 FD CB 36 9E FD CB 85
7520 28 01 3C DF C9 2B 53 50 7760 FD DD E3 EB E3 66 E3 06 7998 7A 3E 20 D7 0E 10 CD 98
7528 29 BA CE C3 BF F2 ED E3 7768 02 21 66 77 CD 31 7A CD 79A0 7A 0B 3E 20 D7 0D 28 05
7530 B1 E3 06 03 21 66 77 CD 7770 BF F9 FB 36 76 04 CD 79A8 20 F8 CD 7A 2A 34 7F 1A
7538 31 7A CD E1 79 DA 41 76 7778 CD E0 75 CD E1 79 30 05 79B0 1B DA 21 BF 79 0E 02 FD
7540 DA 2A 30 7F 5E 23 56 21 7780 CB 7A 20 0D 3E 0A D7 79B8 CB 36 9E 20 0D 3E 0A D7
7548 79 E1 30 06 EB C1 ED B0 7788 36 58 23 36 52 23 36 74 79C0 7D 4F 20 5D A9 8F BF DB
7550 18 22 ED 5B 32 7F C1 C5 7790 4F 32 36 7F CD 85 7A CD 79C8 7B 7A FE 11 CD FD CD 01
7558 CD 23 DB 99 20 DB 99 20 7798 9B 79 78 B1 20 0D 3E 0A 79D0 7D 4F 20 5D A9 8F BF DB
7560 20 F8 C1 E5 EB ED BB D1 77A0 F6 7C CD C9 7A 18 01 FE 79D8 7B 7A 3F A7 ED 52 C9 78
7568 2A 7F CD EB 79 20 F9 C9 77A8 CB 32 CD EB 23 2B 7E 79E0 E6 07 4F 78 F5 E6 38 0F
7570 ED 53 2E 7F C3 FD 76 04 77B0 DD 29 44 FE FD 28 44 CD 79E8 CE 7A CD 25 79 7F ED
7578 02 21 66 77 CD 31 7A 00 77B8 EC 79 2E 24 FE 00 28 11 79F0 07 C9 01 08 09 3E 20 D7
7580 00 CD E1 79 30 DB CD 7A 77C0 2F FE 01 20 0D 3E 0A D7 79F8 10 FD CB 85 7A CB 38
7588 85 7A 24 7F 2E 23 22 7D 77C8 02 28 09 3E 76 32 08 7D 7A00 3E 0D D7 FD 36 52 FF C9
7590 54 7F FE 20 30 08 3E 5F 77D0 2C 7D 81 4F 26 7D 2D 7A 7A08 ED 5B 34 7F CD 74 7A ED
7598 D7 CD 7D 78 10 FD 3E 0D 77D8 CD 7A 78 18 7D CB 98 7A 7A10 5B 34 7F 1A BE 00 FD 7A
75A0 E1 79 DA FD 76 CD 03 08 77E0 CD EC 79 C6 3A 18 EC CD 7A28 ED 52 D0 ED 53 2E 7F C9
75A8 3E 0D 3D 20 FD 3E 0D 77E8 CD 7A 2E 79 20 18 7D 2A 7A30 2A 34 7F 1A BE 00 FD 7A
75B0 18 D5 06 01 21 A6 77 CD 77F0 01 2B BE 2E 20 18 DA 3E 7A35 7F E5 D5 FD 36 76 0C CD
75B8 31 7A FD CB 30 9E FD 36 77F8 54 18 02 3E 86 21 0A 7D 7A38 25 7B D1 C5 06 02 21 00
75C0 75 01 01 00 00 CD 00 00 7800 7D 7C 20 0D 3E 0A D7 7A40 7A 09 ED 52 38 0A 19 ED
75C8 21 36 7F 4E 0D AF 47 4F 7808 23 7E 21 16 7D CD A0 7A 7A48 FB C1 E1 23 23 3E 0D D7
75D0 ED B1 34 7F CD D0 CD 18 7810 23 CB BE CB 98 FD 36 76 7A50 3E 0D D7 10 02 C9 CB 28
75D8 7A 18 E7 C5 DE E5 CD 03 7818 CB 20 05 CD 98 7A 18 B0 7A58 7A 07 07 07 07 F5 23 CB
75E0 0B FD CB 7A 46 28 05 CE 7820 CD EC 79 E5 CD 28 93 F5 7A60 6B 7A 4F F1 81 C9 7E DA
75E8 12 CD D9 CD 21 3A 7F 46 7828 C5 FE 00 20 05 3E 06 B8 7A68 30 FE 06 DB D6 07 C9 21
75F0 5F 2E 00 7E D7 23 10 FB 7830 20 03 CD 98 7A C1 F1 18 7A70 36 7F 46 CB 38 2E 00 CD
75F8 CB 46 20 03 3E 08 D7 FD 7838 011 CD 98 7A AF CB 78 28 7A78 5B 7A 12 13 23 10 FB C9
7600 E1 D1 C1 C9 06 02 CD 6B 7840 2F 48 47 2A 34 7F 09 7A80 11 35 7F 21 FC 7C 1A CD
7608 76 CD E1 79 3D 2E D5 2A 7848 EB 21 FE 7C 7B CD A0 7A 7A88 A5 7A 1B 1A CD A5 7A 3E
7610 2E 7F EB 5B 34 7F 2B 2B 7850 23 CB FE 2B 2B 7A CD A0 7A 7A90 20 0F C9 4F F1 6C 7C ED 5B
7618 79 28 21 38 1F 13 44 4D 7858 7A 18 1F CD 98 7A CB FE 7A98 34 7F 1A 13 ED 53 34 7F
7620 E1 00 EB BD B0 18 ED 53 7860 7B 18 CD 02 7B 18 12 CD 7A A0 CD A0 7A D3 7E D7 C9
7628 2E C5 FD 76 00 00 06 7868 98 79 23 36 A0 18 08 CD 7A A8 47 Ea CF CD B8 7A 28 78
```

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Figure 2. The Starship machine code.

16514	118	118	1	96	1
16519	175	215	11	120	177
16524	32	249	42	14	64
16529	43	34	93	64	229
16534	62	157	1	30	15
16539	215	60	16	252	42
16544	14	64	43	34	95
16549	64	225	205	166	65
16554	42	12	64	30	3
16559	25	34	97	64	62
16564	15	50	99	64	6
16569	16	11	121	176	32
16574	251	17	33	0	42
16579	97	64	229	58	99
16584	64	178	40	37	58
16589	37	64	254	239	32
16594	26	237	82	229	237
16599	75	12	64	237	66
16604	225	56	18	229	33
16609	99	64	53	42	95
16614	64	114	43	34	95
16619	64	225	254	247	32
16624	1	25	229	237	75
16629	93	64	237	66	225
16634	48	95	35	126	254
16639	118	24	2	24	180
16644	32	3	35	35	35
16649	6	3	126	254	136
16654	40	86	43	16	248
16659	35	35	35	34	97
16664	64	227	114	43	114
16669	43	114	225	205	204
16674	65	217	197	217	193
16679	42	100	64	203	65
16684	32	14	42	97	64
16689	43	58	37	64	254
16694	127	32	25	12	6
16699	5	114	25	229	237
16704	91	93	64	237	82
16709	225	56	3	12	24
16714	7	16	3	12	24
16719	2	54	4	197	217
16724	193	217	34	100	64
16729	24	167	225	205	204
16734	65	17	145	65	14
16739	12	24	26	225	17
16744	33	0	54	23	237
16749	82	237	82	54	2
16754	43	54	27	25	25
16759	114	43	54	22	17
16764	157	65	14	9	6
16769	0	33	14	64	52
16774	52	205	107	11	33
16779	125	64	34	41	64
16784	201	184	166	171	170
16789	0	177	166	179	169
16794	174	179	172	23	23
16799	168	183	166	184	173
16804	23	23	17	33	0
16809	43	229	42	123	64
16814	43	124	254	24	56
16819	2	38	24	126	34
16824	123	64	225	230	7
16829	60	71	229	54	136
16834	237	82	16	250	225
16639	43	13	32	223	201
16844	54	46	43	54	156
16849	43	54	130	201	

ZX-81 1K

THESE TWO programs tease yet more out of the valiant 1K ZX-81. Economy is a vital point of good software, and is often synonymous with efficiency. Some might argue that Sinclair's 1K machine has contributed more than any other computer to developing this aspect of programming.

Both programs have a familiar general form, but boast a few extra features of interest. In Starship, your craft is in trouble, circling

```
1 REM 339 BYTES OF MC
2 INPUT A$
3 CLS
4 RAND USR 16516
```

Figure 1.

lower and lower over an enemy city, frantically trying to blast clear an area in which to land. A limited amount of fuel allows the pilot occasionally to gain attitude to clear high buildings.

At the bottom of the display the fuel guage enables you to calculate your descent to a nicety. Even the slightest contact with a building causes a graphic explosion.

With skill the spacecraft may be put down in a small area surrounded by buildings. Keys 1 to 5 take the ship up, 6 to 0 take it down. B of course, releases bombs. At the end of each game, a single keypress restarts.

To enter the machine code type:

```
1 REM 109 characters
```

Check the length of line 1 by typing

```
PRINT PEEK 16511
```

the answer to which should be 111. If it is not, then edit and adjust accordingly. Having done this, edit line 1 twice, changing the line number to 2 and 3 in turn. Now type:

```
POKE 16511,85
POKE 16512,1
POKE 16510,0
```

The last statement prevents your accidentally erasing the line at some later stage in the proceedings. Next, use the following loader program to enter the Starship machine-code dump shown in figure 2.

```
10 FOR N=16514 TO 16852
15 SCROLL
20 PRINT N;
25 FOR K=0 TO 4
30 IF N+K=16853 THEN STOP
35 INPUT I
40 POKE N+K,I
45 PRINT TAB 6+K*5;I;
50 NEXT K
55 PRINT
60 NEXT N
```

If you make a mistake entering the code, stop the loader routine by returning an unused variable name to the prompt for I; change the first address in line 10 to that at which the error was made, and start again from the appropriate point in the dump.

Finally, type in lines 2 to 4 of figure 1, delete the loader routine, and save the program on cassette.

The second program is a zippy version of Breakout. It has the considerable advantage of showing you at the top left of the screen how many of the six available balls have been used up, and at the same time displaying at the bottom left the running score.

Scoring is at the rate of one point per outer brick of the double wall, two for each of the inner bricks, giving a maximum score of 108. any key, 1 to 5, will move the bat down, while any of 6 to 0 moves it up. The score is updated with each new ball. As in the case of Starship, a single keypress restarts at the end of a game.

To type in Breakout, use the same technique outlined for Starship to prepare the large Rem statement for the machine code. On this occasion, however, line 1 should contain 120 characters, giving 122 as the result for

```
PEEK 16511
```

Having copied this Rem statement into lines 2 and 3, type the following statements:

```
POKE 16511,118
POKE 16512,1
POKE 16510,0
```

Use the same loader routine to enter the bytes, changing the second address in line 10 to 16885, and the terminating address in line 35 to 16886. When the dump of figure 4 has been successfully entered, delete the loader again, type in lines 2 and 3 of figure 3 and save it.

In Breakout, speed of play is in inverse proportion to the number stored at location

```
1 REM 372 BYTES OF MC
2 LLPRINT
3 PAUSE USR 16573
```

Figure 3.

16564. A value of 3 gives a very fast and difficult game; 12 is for beginners.

Owners of 16K machines, incidentally, must first reset RAMtop before running these programs. The following direct statements would serve:

```
POKE 16389,69
NEW
```

GAMES

Crushing programs in the ZX-81's 1,000-byte memory vice is common enough. But now Rod Hopkins turns it into a virtue with his fast machine-code games.

WONDERS

Figure 4. The Breakout machine code.

16514	118	118	197	245	205	16699	25	114	16	251	225
16519	245	8	42	14	64	16704	6	3	25	13	32
16524	36	241	215	193	201	16709	252	54	133	25	16
16529	175	190	32	3	52	16714	251	205	179	64	237
16534	52	201	53	53	201	16719	75	123	64	175	185
16539	62	11	185	32	1	16724	40	72	205	132	64
16544	13	62	0	185	192	16729	17	124	64	253	126
16549	12	201	111	38	0	16734	60	126	61	71	16
16554	229	205	245	8	225	16739	27	253	126	61	129
16559	205	171	10	201	6	16744	61	79	16	62	52
16564	8	14	255	13	32	16749	205	132	64	120	33
16569	253	16	249	201	62	16754	60	64	254	1	40
16574	131	1	26	13	205	16759	68	254	12	40	64
16579	132	64	16	251	6	16764	121	254	25	40	64
16584	0	205	132	64	6	16769	254	0	40	25	122
16589	13	205	132	64	13	16774	254	133	40	55	30
16594	32	243	14	20	6	16779	1	254	6	40	5
16599	12	62	149	205	132	16784	254	149	32	132	28
16604	64	16	251	13	121	16789	253	126	64	131	253
16609	254	17	32	241	6	16794	119	64	24	35	253
16614	12	62	8	205	132	16799	52	65	253	54	61
16619	64	16	251	13	121	16804	2	175	205	132	64
16624	254	14	32	241	253	16809	58	54	64	1	2
16629	54	62	2	253	54	16814	13	17	162	65	213
16634	65	0	58	52	64	16819	205	167	64	253	54
16639	230	11	254	2	56	16824	123	8	24	12	205
16644	247	253	119	124	58	16829	145	64	24	187	35
16649	52	64	230	2	203	16834	205	145	64	195	24
16654	71	32	247	253	119	16839	65	42	12	64	35
16659	60	253	54	61	2	16844	58	65	64	198	195
16664	253	78	62	58	37	16849	119	254	163	194	252
16669	64	254	247	32	3	16854	64	33	125	64	34
16674	12	24	5	254	239	16859	41	64	33	14	64
16679	32	4	13	205	155	16864	52	17	237	65	1
16684	64	253	113	52	42	16869	9	0	205	107	11
16689	12	64	35	35	229	16874	6	155	201	44	38
16694	6	12	17	28	0	16879	50	42	0	52	59
						16884	42	55			

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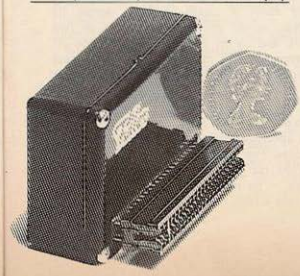

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ORIC 1

```
SPECTRUM 1
10 CLS
20 PAPER 0:BORDER 0
30 LET X=RND*8:
   LET Y=RND*8
40 IF X=Y THEN GOTO 30
50 LET Z=RND*20+8
60 PAPER X:INK Y
70 FOR I =1 TO Z
80 PRINT "";
90 NEXT I
100 GOTO 30
```

```
ORIC 1
10 HIRES
20 FOR N = 41060 TO
   48979 STEP 40
25 M = RND(1)*45 + 1
30 X = RND(1)*24 + 1
35 IF X>=16 THEN X = 0:
40 IF X>=8 THEN X = Z:
   M = J
45 POKE N-M,X + 16
50 Z = X
55 J = M
60 NEXT N
```

```
ORIC 2
100 CLS
200 INL 1
300 FOR I = 1 TO 37
400 PLOT I,8," "
500 PLOT I+1,8,">"
600 NEXT I
700 PLOT 38,8," "
```

```
SPECTRUM 2
10 CLS
20 FOR X = 0 TO 31
30 PRINT AT 10,X;">";
40 PRINT AT 10,X-1;" ";
50 NEXT
```

STARTING GRAPHICS

Tim Langdell contrasts the fine potential of Oric graphics with the proven powers of the Spectrum's display.

ON THE FACE of it both the Oric 1 and the ZX Spectrum have similar graphics and colour capabilities. Both have a similar maximum resolution — the Spectrum has 256 by 175, and the Oric 240 by 200 and both are able to draw lines, circles and plot points. Both can have a maximum of eight colours on the screen at the same time. What, then, are the main differences between these two highly competitive machines?

As far as colour capability is concerned, the major difference between the two machines is that whereas the Spectrum uses a parallel-attribute system, the Oric uses a serial one. In practice, this means that the Spectrum has a separate map or file of the screen's attributes.

These attributes include its possible eight Paper, or background, colours; its eight Ink, or foreground, colours; brightness and flashing. The advantage of this system is that the attribute file is quite independent from the screen display itself, and can be manipulated independently. The Spectrum's attributes act over a character square on the screen eight pixels wide by eight pixels high.

Serial attributes

The Oric's serial attribute system means that a physical character square on the screen acts to inform the computer what colour the rest of the characters on that line should be. An attribute square on the Oric's screen affects all the rest of the bytes on that line until another attribute byte is encountered. With the Oric is you wish to have six blue balls in a row followed by six red ones a character square gap is needed between the two sets of balls to redefine the attributes of the second set as red rather than blue. Note, though, that the Spectrum is mapped in character squares, whereas the Oric's screens attributes are byte-wide single-pixel width lines. To see more clearly what this means Oric owners might like to type in program Oric 1 — multicoloured lines — and note that each pencil-thin line on the screen can be a different colour. However, the Spectrum's colour resolution in this horizontal plane is much chunkier — even when alternating Ink and Paper colours are used to give coloured stripes on the screen: see program Spectrum 1.

The net result of this is that the Oric has the potential of having multicolour characters — in terms of the horizontal lines which make them up — but requires a whole character square gap between different coloured graphics. On the other hand the Spectrum can only have two colours in any given character square, but is not limited to having a gap between characters. Needless to say, one is not a clear winner over the other in these respects, although writing games on the Oric may prove difficult if graphics characters are not to overwrite the attribute characters of other graphics on the screen.

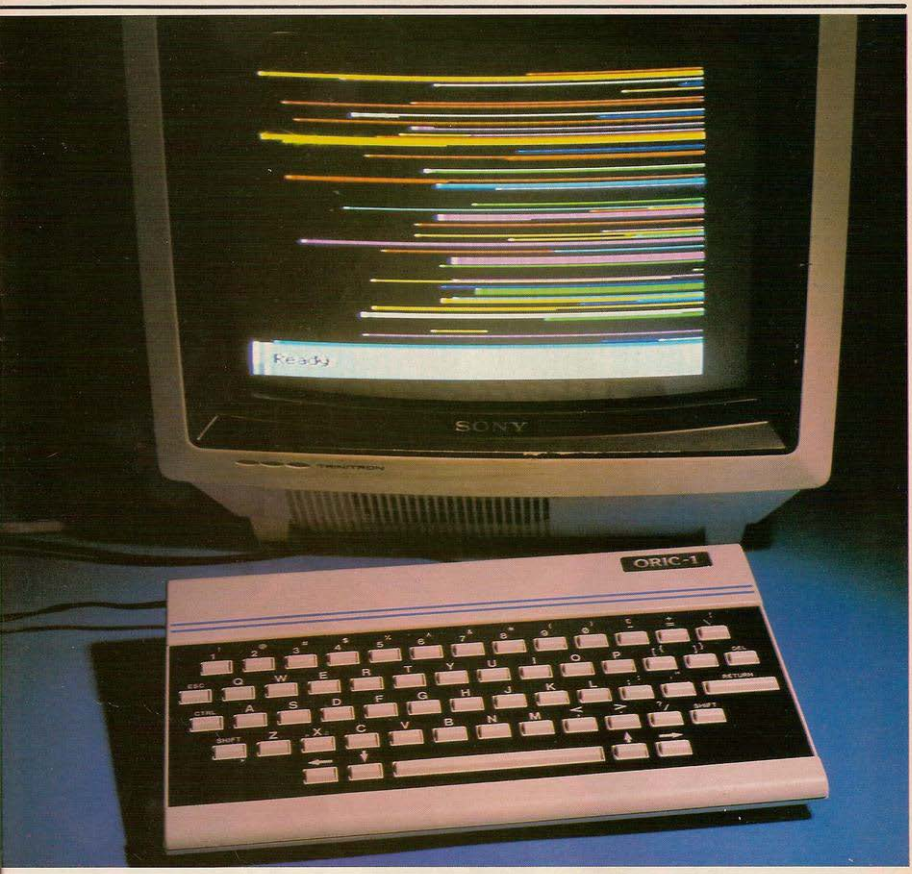
The line drawing capabilities of both machines are pretty similar. They are both relative drawing routines insofar as they draw to a new X and Y co-ordinate from the last point plotted. Whereas the Spectrum has a third parameter which can follow arc, the Oric lacks any such capability. For its part, the Oric has a third parameter which allows one to state whether the line should be drawn in the current Ink colour, the current Paper colour or Exclusive Or with what else is on the screen. These features are available on the Spectrum separately in the form of the Inverse and Over features.

The Oric features two main ways of moving the graphics cursor around the screen, whereas the Spectrum has only one — namely the absolute Plot command at specified X-Y co-ordinates. The Oric uses Curset to achieve this absolute determination of a position, but also featues Curmov which allows you to define a specified displacement from your last position. The Oric also allows you to print a character on the graphics screen according to pixel Plotting X-Y co-ordinates, rather than according to the 24 rows and 40 columns usually used in the Text mode. This is not only useful for putting text on the graphics screen of the Oric but also allows subscripts, superscripts and high-resolution movement in Basic without resort to fantastic tricks. On the Oric the text and so-called high-resolution screens are separate.

Program Oric 2 shows how the Oric can easily move a single character across its graphics screen one pixel at a time, or two pixels, and so on enabling you to trade off between speed of movement and smoothness in writing a game using this feature.

Speed and smoothness

To obtain similar high-resolution movement on a Spectrum from Basic one needs to resort to tricks. For instance, you can calculate how to Poke the necessary bytes directly to the screen — no mean feat with the Spectrum's complex screen format — or set up a column



of 21 user-defined graphics which are all blank except the first, which is the character you wish to move. You can then shift the bytes which make up the characters along one location in memory where the user-defined graphics are held and re-print them to the screen. The result is a smoothly-falling character. Horizontal movement is rather more difficult though. See program Spectrum 2 for an example of this method.

The Oric has two character sets which are both in RAM, and which can both be redefined. This gives a total possible number of user-defined graphics of over 500. At first glance the 21 user-definable graphics on the Spectrum seems paltry in comparison — but in fact considerably more than 500 user-definable graphics can be created with the Spectrum if the tricks to do so are known. In fact, creation of user-defined graphics is really only limited by RAM available. The Spectrum has two addresses in its systems variables — 23606, 23607 — which hold the address of the character-set table — the numbers which the computer uses to create each character. By Poking different values into these locations one can get the Spectrum to read its character set from anywhere in RAM — and thus have many blocks of 256 characters.

Creation of the UDGs themselves is easily done on the Spectrum if one is willing to stick to just 21. This machine offers a

USR " "

feature which allows you to program new characters without having to know the exact locations in RAM where the bytes are to be stored. However, when using the above method for many more characters then both machines require that you know where the character table starts in memory and Poke bytes to this table in carefully calculated blocks of eight bytes.

The Oric has slightly more limited user-defined graphics because only six of the eight pixels in a line of the character can be used. The other two are used to tell the Oric that the byte refers to pattern information rather than attribute information.

All in all, both machines offer an excellent range of facilities to those interested in colour graphics, with the Spectrum having the edge — just — for its ease of programming and using the colours. Time will tell as to whether the Oric's serial attribute system leads to major difficulties in commercial games writing of the excellence so far achieved on the Spectrum. ■

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48K SPECTRUM SPEAKS

No hardware add-ons, just your faithful cassette recorder — John Edwards makes micros talk.

IT IS popular belief that to get a personal computer to speak requires an expensive hardware add-on. This program, written for the ZX-Spectrum will prove otherwise.

Unfortunately the program will only work effectively on a 48K machine, because a lot of memory is required to store any useful amount of speech with sufficiently high fidelity.

The speech is recorded and generated by two extremely short machine-code routines, which take only a few moments to enter. To obtain maximum storage capacity each byte of memory is used to store eight pieces of speech information as opposed to one.

In the following routines the following rule applies: the longer the piece of speech the lower the fidelity. This means that if the short phrase "Good morning" is required, then the fidelity will be high, but if the computer is required to count from one to 100 the fidelity will be so low that the speech will be nothing but indecipherable grating.

The routines are designed to store speech above 32768 which means that if speech is used the user is left with the equivalent of a 16K machine.

The machine code is entered by first typing and running the program in figure 1 which allows machine code to be entered in hexadecimal form.

Run the program and Enter 65280 to the prompt, then enter the hexadecimal code line by line pressing Enter after each line of code.

After you have finished typing in the hexadecimal code just press Enter and the program will stop with an error. Save the machine code with

SAVE "SPEECH"CODE 65279,100

Then type

CLEAR 32767

and New; the program will disappear but the machine code will remain intact. As the routine standard you have about six seconds of recording time.

Set up your cassette recorder to record sounds through a microphone and record something clearly and plainly onto tape. It will be easier if you make a noise before you start so that you will be able to locate your speech easily. Then play your piece of speech through and adjust tone and volume to minimise tape noise.

When you are ready type

RANDOMISE USR 65280

but do not press Enter. Plug the Ear lead between the tape recorder and your computer then start the tape playing. When you hear the noise that precedes your speech through the computer's loudspeaker press Enter.

After about six seconds a report code should appear at the bottom of the screen and when this happens you can stop the tape recorder. You can now test the speech by typing

RANDOMISE USR 65308

If the speech is not very clear then repeat the process of recording with different levels. You will find that the speech sounds better if you connect the Mic lead to an external amplifier.

If you cannot get the machine code to work, reload it and check it through, by Peeking the locations from 65280 onwards.

Any speech recorded by the program can be Saved by

SAVE "SPEECH"CODE 32767,65279-32767

and Load by

LOAD ""CODE

The program can also be used for realistic sound effects.

Figure 1.

```
  10 DEF FN k(x)=CODE "012345678
90000000:;<=>?000000000000000000
00000000:;<=>?"(CODE a$(x)-47)-48
  15 REM <=> are three characters
  20 LET a$=""
  30 INPUT x
  40 IF a$="" THEN INPUT a$
  50 POKE x,16*FN k(1)+FN k(2)
  55 PRINT x,a$( TO 2)
  60 LET a$=a$(3 TO )
  70 LET x=x+1
  80 GO TO 40
```

Figure 2. Machine-code listing

```
HEX                 MNEMONICS

F3        HEAR      DI
210080              LD HL,32768
0608      HLP1      LD B,8
DBFE      HLP2      IN A,(254)
CB77                BIT 6,A
2002                JR NZ,2
CBFE                SET 7,(HL)
CB3E                SRL (HL)
10F4                DJNZ HLP2
CB0E                RRC (HL)
23                  INC HL
7C                  LD A,H
FEFE                CP 254
20EA                JR NZ,HLP1
FB                  EI
C9                  RET
F3        TALK      DI
210080              LD HL,32768
0608      TLP1      LD B,8
CB46      TLP2      BIT 0,(HL)
2804                JR Z,4
3E00                LD A,0
D3FE                OUT (254),A
3EFF                LD A,255
D3FE                OUT (254),A
CB06                RLC (HL)
10F0                DJNZ TLP2
CB06                RLC (HL)
23                  INC HL
7C                  LD A,H
FEFE                CP 254
20E6                JR NZ,TLP1
FB                  EI
C9                  RET
```

■

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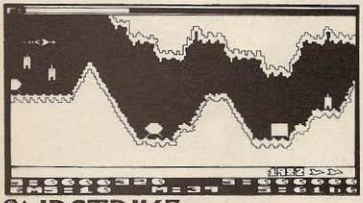

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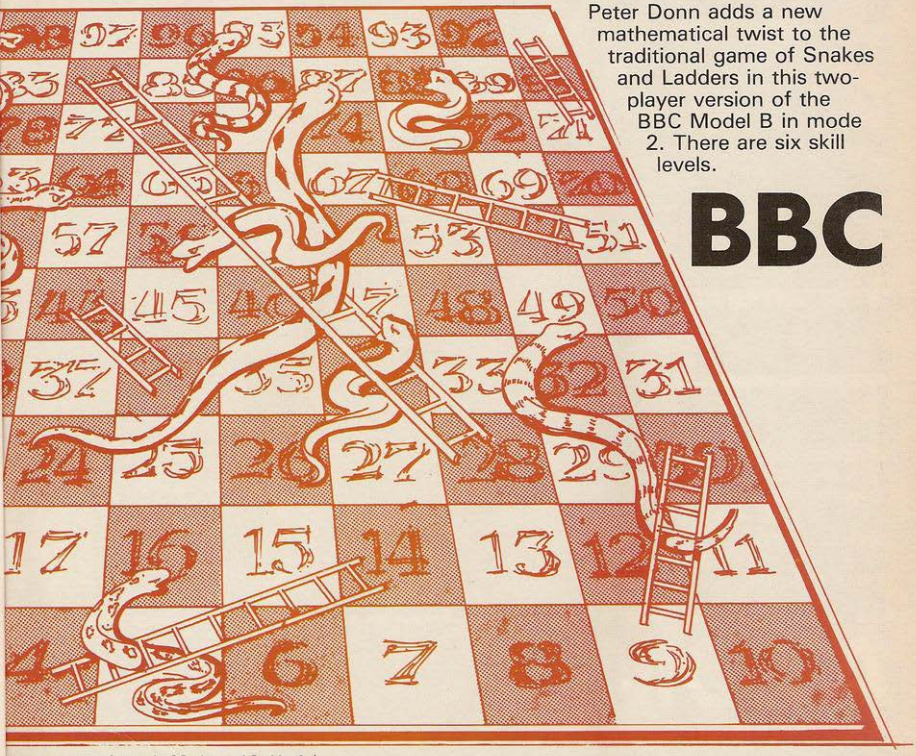
SNAKES AND LADDERS

Peter Donn adds a new mathematical twist to the traditional game of Snakes and Ladders in this two-player version of the BBC Model B in mode 2. There are six skill levels.

BBC



WHAT IS THE appeal of Snakes and Ladders? Does it lie in its ability to mirror the unpredictable ups and downs of life — or is it a throwback to Biblical times when snakes could be relied upon to lead you astray?

Whatever the case may be, I have developed a complete representation of this game on the BBC Model B computer which utilises its colourful graphics to the full potential and likewise the sound capabilities. One substantial feature has been added to the game. There are mathematical questions, the difficulty of which is stated at the start. This educational Snakes and Ladders is ideal for those between the ages of 2 and 16.

The program is split up into two parts which are loaded one after the other. This is simply because of the lack of memory on the BBC Model B using mode 2. The first part is concerned mainly with the definition of graphics characters, and there are quite a few of them.

The game is for two players and when Run asks them for their names. You then choose the difficulty level: level 1 is the easiest, and level 6 is the hardest. It is still possible to get easy questions on level 6 though, because the level decides on the range of values the computer chooses from when deciding on the question to give you.

(continued on page 115)

32K BBC ALL O.S.'s

PAINTER Written entirely in machine code this fast arcade style game features sixteen different screen presentations and six skill levels which make the game harder as you get better. **£8.00**

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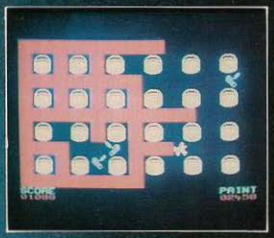

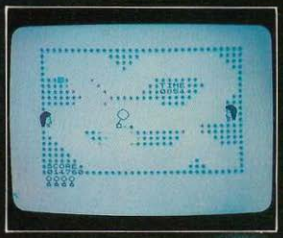

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(continued from page 111)

As you watch the display being built up, you will see that there is a border around the edge, the main board on the left two-thirds of the screen, and each player's dice and score on the top-right and bottom right of the screen. On the left-hand side of the screen, in the border, is displayed the current skill level.

A question — adding, subtraction, multiplication or division — is given as someone is about to go up a ladder or down a snake. You have eight seconds to answer a question. Once a number is typed it cannot be deleted. Should you finish before the time is up, pressing the space-bar will continue the program. Getting the question right will either allow you to go up a ladder or not go down a snake, depending on your position.

Just in case the program does not make it clear, to roll your dice press D. Your dice will roll a few times with the appropriate sound effects. You are then asked if you are ready to move. If you are, press Y. If you are lucky enough to get a six on your dice, you can have another go. The winner is the first person to jump off the last square of the board, at the top right. The program then plays *For He's a Jolly Good Fellow*, and the players can decide if they want another go. If so, 1 is added to their score — displayed on the screen — and the game is restarted, with an option to change the skill level again. If not, new players can play, and the game is automatically run again.

```
   10 REM****** SNAKES & LADDERS ******
   20 REM******    COPYRIGHT     ******
   30 REM******   PETER DONN    ******
   40 REM******   AUGUST 1982   ******
   50
   60 MODE2
   70 *FX11,0
   80 *FX9,10
   90 *FX10,10
  100 ENVELOPE1,1,1,1,-1,10,10,20,0,0,-1,-2,126,100
  110 ENVELOPE2,5,10,-10,10,3,3,3,0,-1,-2,-3,126,126
  120 VDU23,224,0,0,4,2,255,2,4,0,23,225,0,0,32,64,255,64,32,0,23,226,126,24#,24
9,175,5,83,255,255,23,227,126,159,159,245,192,202,255,255,23,229,15,15,31,61,60,
120,96,128,23,228,240,240,248,124,60,22,6,1,23,230,0,0,24,24,0,0,0
  130 VDU23,231,24,126,90,219,126,102,90,129,19,0,2,0,0,0,19,2,0,0,0,0,23,232,0,
0,0,0,0,0,24,24,23,233,24,24,0,0,0,0,0,0,23,234,0,0,96,96,96,96,0,0,23,235,0,0,6
,6,6,6,0,0,23,236,192,192,192,192,0,0,24,24,23,237,24,24,0,0,3,3,3,3
  140 VDU23,238,195,195,195,195,195,195,0,0,0,0,23,239,0,0,0,0,195,195,195,195,23,240,#9
5,195,195,195,0,0,24,24,23,241,24,24,0,0,195,195,195,195,23,242,195,195,195,195,
0,0,195,195,23,243,195,195,0,0,195,195,195,195
  150 VDU23,244,24,24,0,255,0,24,24,0,23,245,66,102,36,24,36,102,66,0
  160 PRINTTAB(2,8);"PART ONE LOADED"
  170 PRINTTAB(10,18);"for part 2";CHR$11:CHR$11
  180 CHAIN"Sn+La"

LIST
    5 REM SNAKES AND LADDERS PART 2 - (C) PETER DONN '82
   10HZ=0:JZ=0:DIM A(4,65):MODE2
   20A=0:TIME=0:CLS:MO=1:RN=0:TR=0:RN2=0:TR1=0:POS1=0:POS2=0:U$=CHR$8+CHR$10:RES
TORE
   30IFHZ>0ORJZ>0THENB0
   40COLOUR2:GCOL0,1
   50PRINTTAB(2,8);"WELCOME";TAB(12,8);"TO";VDU5:GCOL0,1:Q=INKEY(100)
   60Y$="  S N A K E S   A N D   L A D D E R S";FORX=1TO39:MOVEX*1280/40,(300+SIN(
X/6))/2+800:PRINTMID$(Y$,X,1):NEXT:GCOL0,3:INPUT''''''''"ENTER PLAYERS NAMES:"''''
"1) "Z$,"2) "Y$
   70PROCSK:IFRND(2)=1A$=Z$:B$=Y$ELSEA$=Y$:B$=Z$
   80VDU4:CLS:VDU5:GCOL3,1:MOVE0,80:PRINT"   WAIT PLEASE";0%=0
   90VDU19,0,2,0,0,0,19,2,0,0,0,0
  100GCOL0,6:MOVE100,112:MOVE100,912:PLOT85,980,912:MOVE980,112:PLOT85,100,112:8
GCOL0,5:FORY=113TO912STEP200:FORX=10:TO980STEP220:PROCdraw:NEXT:NEXT
  110FORY=213TO912STEP200:FORX=211TO980STEP220:PROCdraw:NEXT:NEXT
  120GCOL0,7:FORY=143TO942STEP200:FORX=872TO101STEP-110:A=A+1:A(1,A)=X+2:A(2,A)=
Y+35:MOVEX+25,Y:PRINTCHR$225:NEXT:A=A+8:NEXTY:A=8
  130FORY=243TO1042STEP200:FORX=101TO871STEP110:A=A+1:A(1,A)=X+2:A(2,A)=Y+35:MOV
EX+25,Y:PRINTCHR$224:NEXT:A=A+8:NEXT
  140FORSN=1TO12:PROCSNAKES:NEXT:FORHEAD=1TO4:READHX,HY:MOVEHX,HY:PRINTCHR$226:N
EXT
  150MOVE761,840:PRINTCHR$227:MOVE211,540:PRINTCHR$227:MOVE651,313:PRINTCHR$228:
MOVE321,713:PRINTCHR$228:FORTA=1 TO 4:READTX,TY:MOVETX,TY:PRINTCHR$229:NEXT:FORL
A=1TO7:PROCLADDERS:NEXT:GCOL0,1:PROCGAME
  160IFPV=813 Z$=A$:HX=HX+1 ELSEZ$=B$:JX=JX+1
  170VDU19,0,12,0,0,0,19,2,2,0,0,0:GCOL0,2:MOVE200,450:MOVE200,750:PLOT85,830,75
0:MOVE830,450:PLOT85,200,450:GCOL0,15:COLOUR15:VDU4:PRINTTAB(5,10);"WINNER";TAB(
7,12);"IS";TAB(8-(LEN(Z$))/2,14);Z$:VDU4
  180RESTORE900:FORMX=1TO31:READPX,LX,CX:IFCX<>0PROCSOZ
  190SOUND1,-15,PX,LX*3:FORTX=0 TO LX*1000:NEXT:*FX15,7
  200FORZ=0TO100:NEXT:MIN=(TIME DIV 6000)MOD 60:SEC=(TIME DIV 100)MOD 60
  210VDU20,4:CLS:COLOUR6:PRINTTAB(2,2);"DURATION OF PLAY:";TAB(3,4);MIN;" MINS
";SEC;" SECS"
  220COLOUR2:PRINTTAB(3,7);"WOULD YOU LIKE"'TAB(4,9);"ANOTHER GAME";TAB(9,11);"?
";X$=GET$
  230IFX$<>"Y"THEN250
  240PRINTTAB(0,25);"    Same players?";X$=GET$:IFX$="Y"PROCSK:Z$=A$:Y$=B$:GOTO2
0 ELSE CLEAR:HZ=0:JZ=0:RUN
  250IFX$<>"N"COLOUR12:PRINTTAB(3,18);"ANSWER PROPERLY";TAB(7,15);"PLEASE";A=INK
EY(200):CLS:GOTO220 ELSE MODE7:PRINT'"BBC Computer"'"BASIC":END
  260DATA415,215,424,200,439,258,452,246,452,246,452,258,312,330,304,313,840,208
,864,196,896,347,927,335,927,335,899,317,840,515,868,526,653,296,666,312,174,383
,195,405,105,405,204,402,234,518,209,533
  270DATA519,410,532,396,581,457,562,467,583,454,559,454,478,678,504,682,504,667
,484,680,765,828,782,813,748,512,760,500,818,670,795,670,818,670,804,658,746,712
,754,724,320,700,336,712,326,824,311,815
  280DATA261,345,811,540,701,740,261,840,371,213,811,213,481,413,701,513,599,189
,639,175,801,319,775,342,167,292,194,270,464,524,441,548,611,401,638,384,608,526
,667,544,883,472,916,495,861,740,829,716
  290DATA166,597,197,579,483,822,441,841,551,581,579,598,526,750,495,720,226,773
,255,801,198,842,174,824,23,6,34,2,39,14,51,30,63,21,58,43,4,18,9,37,20,35,32,50
,36,53,40,60,55,57
  300 DEFPROCdraw:MOVEX,Y:MOVEX,Y+100:PLOT85,X+110,Y+100:MOVEX+110,Y:PLOT85,X,Y:
ENDPROC
  310DEFPROCSNAKES:GCOL0,1:READX,Y,X1,Y1,X2,Y2,X3,Y3:MOVEX,Y:MOVEX1,Y1:PLOT85,X2
,Y2:MOVEX3,Y3:PLOT85,X,Y:ENDPROC
```

(listing continued on next page)

Playing the game

Firstly, type in program 1. Run it to see if it works — and make sure it does. All it displays is a green mode 2 screen, and some writing saying that the first part is loaded and the computer is ready for the second part. Save the program on cassette calling it:

SN&LA

Now press Break and type in the second program. Do not run this but save the tape calling it:

SN + LA

Now press break and type:

PAGE = &D00 (return)
NEW (return)

This is to give access to a further 256 bytes of memory which is not being used. Type this also before loading the game in future.

Chain the first program and continue to load the second program which should have been saved on tape after the first program. Any errors in the second program can now be dealt with. Do not at any time press Break. If you do this, you will be greeted by

BAD PROGRAM

If you do — type:

PAGE = &D00 (return)
?&E00 = 65 (return)
?&E01 = 65 (return)

and the program can now be listed. But you will find that after the first page of memory there are two letter As, which seem to have appeared from nowhere. You will have to correct that part of the program. It makes things that much easier if you do not press Break. To make correcting errors easier, type Mode 7 after the error report, and Print ERL. Alternatively, add the following line at the start, and delete it once the program is running correctly:

5 ON ERROR MODE7:PRINT"":REPORT: PRINT" at line ";ERL:END

For the sake of those people who are interested in the BBC features used in the program and some of the techniques involved in the production of the program, and also those people who are mad enough to want to try to convert the program to work on another computer, here is a breakdown of the program.

Program outline

Program 1, line 70 sets up the delay time in the auto-repeat function of the keys. Lines 80 and 90 set up the colour flash rates. 100 and 110 define sound effect envelopes. Lines 120-150 store character definitions in memory locations &C00 to &D00 and represent characters 224 to 244. Most are dice numbers. Line 180 loads the second program.

In program 2, lines 10 to 20 set up various variables used in the program. U$ saves space

(continued on next page)

(continued from previous page)

later in the program where it is needed to plot the top and bottom of the dice. CHR$8 is the backspace cursor, CHR$10 takes the cursor down one line. In line 10 an array is set up which stores the co-ordinates of the corner of each square. It also tells the computer if there is a snake or ladder end on the square. Line 30 checks to see if a program has been played before. H% and J% are the scores. Line 60 prints up the title in a sine wave form — like a snake — and allows input of the names into Z$ and Y$. At line 70 the computer decides who is to go first. From 100 to 130 the screen display is built up and the array is filled with the appropriate co-ordinates. At line 140 heads and tails are put onto the ends of the snake body. Then, at 150 ladders are plotted and the game is started. The finale of the game is at lines 60 to 250. There are options to have another game. The data of all co-ordinates of all turning points on snakes, and ends of sides of each ladder are contained in lines 260-290. Line 300 is the procedures to draw the box — each section of the board, and line 310 is the procedure to draw snakes' heads and tails.

Climbing the ladder

Line 320 is the procedures to draw rungs on ladders. A mathematical approach was used here. The distance between the two points X,Y and P,Q on a Cartesian co-ordinate system is given by

SQR ((ix-p)squared) + ((iy-q)squared))

Since we know the coordinates of the top and bottom of the sides of the ladder, we can now find out how many rungs there are on each ladder — if the distance between the rungs on all ladders is the same. We then plot a rung at the right points up each ladder. At 340 the game itself starts. A 1 is put into the array

A(4, ?)

The question mark represents the numbers of the squares which contain the bottom of a ladder or the top of a snake. At lines 390 to 530 the first player starts, throws his dice and makes his move. The second player's turn comes at lines 540 to 670. 690 to 740 contain the six routines for plotting the dice number — one for each possible roll of the dice. Line 750 is the procedure to actually go about plotting dice, making a rolling sound, and leaving a consecutively smaller gap between successive frames of the dice throw. Lines 800 to 890 actually move down a snake or up a ladder, if the question has been answered correctly. Line 900 contains the data for *For He's a Jolly Good Fellow,* and line 920 chooses a question.

Range of values

Lines 930 to 1010 put a question on the screen and check for an answer in a limited time. Line 1090 gives a range of values chosen by the computer for maths questions. The range is different for division, multiplication, addition, and subtraction.

For those of you who are just a bit lazy, and would like to take the easy way out, send a cheque or P.O. for £2.80 to the following address, and I will send you a copy of the program on a cassette, ready and working: Peter Donn, 33 Little Gaynes Lane, Upminster, Essex, RM14 2JR.

(listing continued from previous page)

```
320DEFPROCLADDERS:GCOL0,4:READX,Y,X1,Y1,X2,Y2,X3,Y3:MOVEX,Y:DRAWX3,Y3:MOVEX1,Y
1:DRAWX2,Y2:LE=(SQR((X3-X)^2)+((Y3-Y)^2)))/40:LEX=(X3-X)/LE:LEY=(Y3-Y)/LE:LEX1=
(X2-X1)/LE:LEY1=(Y2-Y1)/LE
330N=X:M=Y:N1=X1:M1=Y1:FORJ=1TOLE:N=N+LEX:M=M+LEY:N1=N1+LEX1:M1=M1+LEY1:MOVEN,
M:DRAWN1,M1:NEXT:ENDPROC
340DEFPROCGAME:FORA=1TO13:READSNH,SNT:A(3,SNH)=1:A(4,SNH)=SNT:NEXT:GCOL3,1:MOV
EO,80:PRINT"   WAIT PLEASE":COLOUR3:VDU4:PRINTTAB(1,2);A$;" STARTS":VDU5:GCOL0,3
350MOVE1075,813:MOVE1175,813:PLOT85,1175,913:MOVE1075,913:PLOT85,1075,813:MOVE
1070,800:PRINTLEFT$(A$,2),TAB(18,12);M%:GCOL0,2:MOVE1075,113:MOVE1175,113:PLOT85
,1175,213:MOVE1075,213:PLOT85,1075,113
360MOVE1070,255:PRINTLEFT$(B$,2),TAB(18,18);Z%:COLOUR4:VDU4:X$="G A M E S  W O
N":FORZX=1TOLEN(X$):PRINTTAB(16,7+ZX);MID$(X$,ZX,1);:NEXT:VDU5:GCOL3,3:MOVEA(1,1
),A(2,1):PRINTCHR$231:GCOL3,1:MOVEA(1,1)+46,A(2,1):PRINTCHR$231:POS1=1:POS2=1
370MOVE16,512:PRINTa-48
380IFPOS1<>1GCOL0,3:COLOUR3:PROCL(29):PROCL(2):VDU4:PRINTTAB(2,2);"TURN:";A$:V
DU5
390PV=813:GCOL3,3:*FX15,1
400PROCL(29):COLOUR3:VDU4:PRINTTAB(1,29);"KEY D TO THROW DICE":VDU5:GCOL3,2
410D$=GET$:IFD$<>"D"THEN410
420IFRN<>0PROCSUB(RN)
430RN=RND(6):PROCDICE(RN):PROCL(29):COLOUR3:GCOL0,3:VDU4:PRINTTAB(1,29);"READY
TO MOVE?":VDU5:GCOL3,3:*FX15,1
440M$=GET$:IFM$<>"Y"THEN440
450FORJM1=POS1 TOPOS1+RN:IFJM1>64 NEXT:ENDPROC
460IFTR=1ORJM1=POS1 ORJM1=1 MOVEA(1,JM1),A(2,JM1):PRINTCHR$231
470IF#=0
480IFJM1<>1MOVEA(1,JM1),A(2,JM1):PRINTCHR$231
490FORZ=0TO999:NEXT
500IFJM1<>1 ANDJM1<>POS1+RN MOVEA(1,JM1),A(2,JM1):PRINTCHR$231
510IFJM1<>POS1+RN SOUND2,1,A(1,JM1)/4,1:SOUND3,1,A(2,JM1),1
520NEXT:POS1=POS1+RN:IFA(3,POS1)=1PROCSNORL(0,POS1)
530IFRN=6THEN380
540PV=113:PROCL(29):PROCL(2):COLOUR2:VDU4:PRINTTAB(2,2);"TURN:";B$:VDU5:*FX15,
1
550PROCL(29):COLOUR2:VDU4:PRINTTAB(1,29);"KEY D TO THROW DICE":VDU5:GCOL3,7
560D$=GET$:IFD$<>"D"THEN560
570IFRN2<>0PROCSUB(RN2)
580RN2=RND(6):GCOL3,7:PROCDICE(RN2):GCOL0,2:PROCL(29):GCOL0,2:COLOUR2:VDU4:PRI
NTTAB(1,29);"READY TO MOVE?":VDU5:GCOL3,1:*FX15,1
590M$=GET$:IFM$<>"Y"THEN590
600FORJM2=POS2 TOPOS2+RN2:IFJM2>64 NEXT:ENDPROC
610IFTR1=1 ORJM2=POS2 ORJM2=1 MOVEA(1,JM2)+46,A(2,JM2):PRINTCHR$231
620TR1=0:IFJM2<>1 MOVEA(1,JM2)+46,A(2,JM2):PRINTCHR$231
630FORZ=0TO999:NEXT
640IFJM2<>1 ANDJM2<>POS2+RN2 MOVEA(1,JM2)+46,A(2,JM2):PRINTCHR$231:SOUND2,1,A(
1,JM2)/4,1:SOUND1,1,A(2,JM2),1
650IFJM2<>POS2+RN2 SOUND2,1,A(1,JM2)/4,1:SOUND3,1,A(2,JM2),1
660NEXT:POS2=POS2+RN2:IFA(3,POS2)=1PROCSNORL(46,POS2)
670IFRN2=6THEN540
680GOTO380
690MOVE1096,77+PV:PRINTCHR$232+U$+CHR$233:RETURN
700MOVE1097,78+PV:PRINTCHR$234+U$+CHR$235:RETURN
710MOVE1097,80+PV:PRINTCHR$236+U$+CHR$237:RETURN
720MOVE1098,80+PV:PRINTCHR$238+U$+CHR$239:RETURN
730MOVE1098,80+PV:PRINTCHR$240+U$+CHR$241:RETURN
740MOVE1098,80+PV:PRINTCHR$242+U$+CHR$243:RETURN
750DEFPROCDICE(DI):SOUND1,0,60,1:INC=1:FORDTH=1 TO 1000:IFDTH<>1PROCSUB(RNTH)
760INC=INC*1.5:DTH=DTH+INC:RNTH=RND(6):PROCSUB(RNTH):*FX15,5
770SOUND0,-15,3,2:FORZX=1TOINC*10:NEXT:NEXT
780PROCSUB(RNTH):*FX15,5
790SOUND0,-15,3,2:PROCSUB(DI):ENDPROC
800DEFPROCSNORL(DIF,APOS):AR=A(4,APOS):AR1=APOS:IFA(2,AR1)<A(2,AR)DIR=4 ELSEDI
R=-4
810PROCD:IF(GX=0 ANDDIR=4)OR(GX=1 ANDDIR=-4)ENDPROC
820MOVEA(1,APOS)+DIF,A(2,APOS)
830FORDX=A(2,AR1)/4 TOA(2,AR)/4STEPDIR:SOUND1,-15,DX,1:SOUND3,-15,DX+32,1:NEXT
840PRINTCHR$231:MOVEA(1,AR)+DIF,A(2,AR):PRINTCHR$231:IFPV=813 POS1=AR:TR=1 ELS
EPOS2=AR:TR1=1
850ENDPROC
860DEFPROCL(BAT):VDU4:PRINTTAB(0,BAT);SPC(20);:VDU5:ENDPROC
870DEFPROCSUB(DT):ON DT GOSUB690,700,710,720,730,740:ENDPROC
880DEFPROCSO2:*FX15,7
890SOUND2,-12,CX,100:ENDPROC
900DATA129,1,0,117,3,53,117,1,0,117,1,0,113,1,0,117,1,0,121,3,0,117,2,0,117,1,
0,109,3,33,109,1,0,109,1,0,101,1,0,109,1,0,117,3,53,101,2,0,109,1,0,117,3,0,117,
1,0,117,1,0,109,1,0,117,1,0,121,2,25,129,1,0,137,2,0,137,1,0,129,2,53
910DATA121,1,0,117,2,33,109,1,0,101,4,53
920DEFPROCO:PROCL(2):PRINTTAB(4,2);"QUESTION":SOUND3,2,100,1:FORZ=0TO5000:NEXT
:A%=RND(4):ONA%GOSUB930,950,980,1000:ENDPROC
930BX=RND(MX):LX=RND(MX):PROCL(29):PRINTTAB(5,29);BX;"+";LX;"=";:PROCANS:NX=BX
+LX:IFX=NX&X=1ELSE&X=0
940PROCREM:RETURN
950BX=RND(IX):LX=RND(IX):IFLX>BX THEN950
960PROCL(29):PRINTTAB(5,29);BX;"-";LX;"=";:PROCANS:NX=BX-LX:IFX=NX&X=1ELSE&X=
0
970PROCREM:RETURN
980BX=RND(UX):LX=RND(UX):PROCL(29):PRINTTAB(5,29);BX;CHR$245;LX;"=";:PROCANS:N
X=BX*LX:IFX=NX&X=1ELSE&X=0
990PROCREM:RETURN
1000BX=RND(RX):LX=RND(RX):PROCL(29):PRINTTAB(5,29);BX*LX;CHR$244;LX;"=";:PROCAN
S:NX=BX:IFX=BX&X=1ELSE&X=0
1010PROCREM:RETURN
1020DEFPROCANS:C$="":EX=TIME:REPEATE$=INKEY$(0):IFASCE$<48ORASCE$>57THEN1040
1030C$=C$+E$:PRINTE$;
1040UNTILTIME>EX+800 OR E$=" ":FX=VAL(C$):ENDPROC
1050DEFPROCREM:PROCL(29):VDU4:PRINTTAB(4,29);:IFGX=1PRINT"CORRECT":FORZ=-15TO0:
SOUND0,7,1,2:NEXTELSEPRINT"WRONG: IT'S ";NX:FORZ=-15TO0:SOUND0,7,4,2:NEXT
1060FORZ=0TO3000:NEXT:VDU5:ENDPROC
1070DEFPROCSK:PRINTTAB(0,25):"Select level (1-6)"
1080a=GET:IFa<49ORa>54THEN1080
1090MX=INT((a-48)^3)*5:IX=INT((a-48)^3)*5-((a-48)^2):UX=INT(a-48)*5:RX=INT(((a-
48)*5)/2)
1100ENDPROC
>
```

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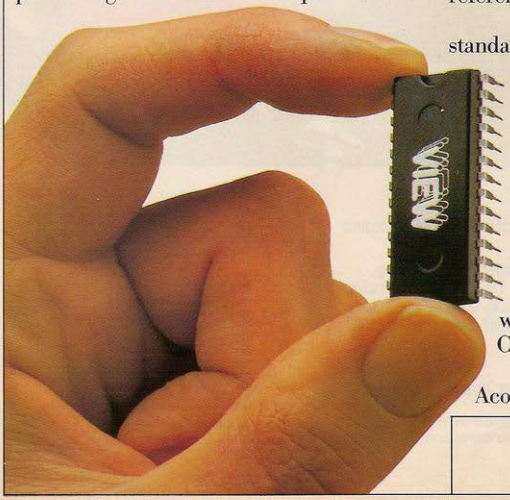
View is supplied as a Rom chip that can easily be fitted to your BBC Micro by your local dealer, in a painless two-minute operation.

Then, once installed, you only have to switch on and View is operating immediately. (You can easily switch back to normal computing with a single command.)

Also included in the View package are two special books: 'Into View,' that takes you by easy stages through all the word processing commands and explains the many ways in which View can help you, and the 'View Guide,' which provides a quick reference to all View facilities.



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The 'Spark-Jet Printer' shown in the photograph is the ideal choice of printer for your word processing application. Extremely quiet, it offers high resolution graphics from monitor or T.V. screen and is available now from dealers.

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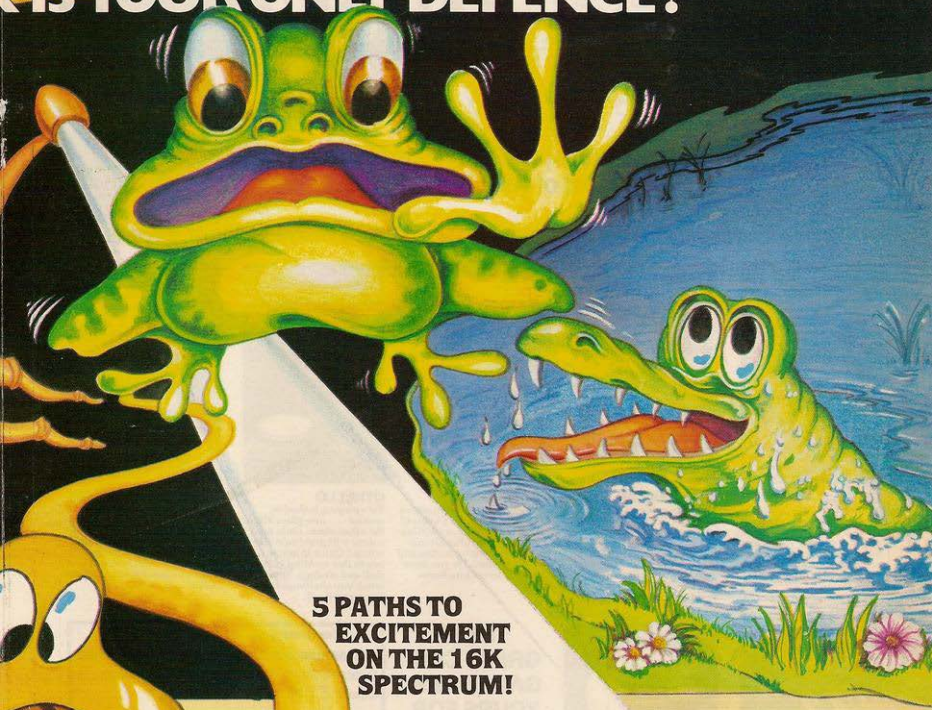

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Two players locked in combat . . . one plays black, the other white. Only one colour will dominate. But which? Quick thinking is the key to this exciting game of skill and strategy. Especially when you challenge the computer itself.

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```
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   20REM SHAPES FOR ACOR
N ATOM
   30REM BY S.YEWDALL
   40REM THIS PROGRAM MA
Y BE FREELY COPIED
   50REM PROVIDED A CRED
IT LINE IS INCLUDED
   60REM
   70DIM RR(31),VV(31),F
(10)
   80Z=#90;W=Z+8;D=W+6;S
=D+8
   90M=#2920
   100FOR I=0 TO 30;VV(I)
=M;RR(I)=M;N.
   110P.$21;GOSUB 150
   120P.$6
   130GOSUB 150
   140END
   150P=M;[
   160JMP VV20
   170JMP VV24
   180JMP VV27
   190JMP VV15
   200\(SET THE POINTERS(
   210\(SAVE A(
   220:RR0 STA Z
   230\(CLEAR MSB'S(
   240LDA @0;STA Z+1;STA
Z+3;STA Z+5;STA Z+7
   250\CALC A*4
   260LDA Z;CLC
   270ROLA;ROL Z+3;ROLA;R
OL Z+3
   280STA Z+2
   290\SET XP C=0 A=LSB
   300ADC #303;STA Z+6
   310LDA Z+3;ADC #31E;ST
A Z+7
   320\SET YP
   330CLC;LDA Z+2;ADC #30
4;STA Z+4
   340LDA Z+3;ADC #31F;ST
A Z+5
   350\SET AP
   360CLC;LDA Z+2;ADC #2E
C;STA Z+2
   370LDA Z+3;ADC #307;ST
A Z+3
   380\SET DP
   390LDY @1;LDA (Z+2),Y
   400\CALC D*8
   410CLC;ROLA;ROL Z+1;RO
LA;ROL Z+1;ROLA;ROL Z+1
   420ADC #2E F;STA Z
   430LDA Z+1;ADC #30A;ST
A Z+1
   440RTS
   450\(((
   460\SET SHAPE VALUES
   470\(((
   480\HERE FOR RUBOUT
   490\STAT1=BG
   500:RR1 LDY@0;LDA(Z+2)
,Y;AND @3;STA D+0
   510\STAT2=FG
   520LDA (Z+2),Y;AND @&C
4;STA D+1
   530LDA (Z+2),Y;LSRA;LS
RA;LSRA;AND @3;ORA D+1
   540JMP RR3 \(
   550\
   560\RTS WITH C=1 IF <>
LIMITS
   570\LIMITS FFFFFF00-FF
   580\
   590\SET STAT1
   600:RR2 LDY @0;LDA (Z+
2),Y;LSRA;LSRA;LSRA;AND
@3;STA D+0
   610\SET STAT2
   620LDA (Z+2),Y;AND @&C
7
   630:RR3 STA D+1
   640\TEST MSB X CO-ORD
   650LDY @3;LDA (Z+6),Y;
STA W;BEQ RR4;CMP @&FF;B
NE RR6
   660\OK 00 OR FF
   670\TEST MSB Y CO-ORD
   680:RR4 LDA(Z+4),Y;STA
 W+1;BEQ RR5;CMP @&FF;BN
E RR6
   690\SET X & Y SIZE
   700:RR5 LDA (Z+2),Y;ST
A D+2;AND @&F;CLC;ADC @1
;STA D+3
   710LDA D+2;AND @&F0;LS
RA;LSRA;LSRA;LSRA;ADC @1
;STA D+2
   720\TEST SECOND DIGITS
   730DEY;LDA (Z+6),Y;CMP
 W;BNE RR6
   740LDA(Z+4),Y;CMP W+1;
BEQ RR7
   750:RR6 SEC;RTS
   760\OK ARE 00 OR FF
   770\TEST THIRD DIGITS
   780:RR7DEY;LDA (Z+6),Y
;CMP W;BNE RR6
   790\X CO-ORD OK STORE
IT
   800:RR9 STA D+5
   810LDA (Z+4),Y;CMP W+1
;BNE RR6
   820\Y CO-ORD OK
   830:RR11 STA D+7
   840DEY;LDA (Z+6),Y;STA
D+4
   850LDA (Z+4),Y;STA D+6
   860\ALL OK
   870CLC;RTS
   880\(((
   890\PLOT ROUTINE
   900\(((
   910\A=SHAPE
   920\SET POINTERS
   930:VV20 JSR RR0
   940\CHECK RANGE
   950JSR RR2;BCS VV21
   960\DRAW SHAPE
   970JSR VV0
   980\TEST FOR CHAIN
   990:VV21LDY @0;LDA (Z+
2),Y;AND @&20;BEQ VV22
   1000LDY @2;LDA (Z+2),Y;
JMP VV20
   1010:VV22 RTS
   1020\(((
   1030\   THE UNPLOTER
   1040\(((
   1050\SET POINTERS
   1060:VV24 JSR RR0
   1070\CHECK RANGE
   1080JSR RR1;BCS VV25
   1090\UNPLOT IT
   1100JSR VV0
   1110\CHECK FOR CHAIN
```

(listing continued on next page)

Stephen Yewdall's graphics aid harnesses the speed of machine code to drive your games with more style.

MANY ATOM owners have read with envy articles describing the latest computers and their graphic capabilities. Now help is at hand: whether you wish to produce text, graphics animation, or games, these routines will bring your Atom to life.

Written in machine code for use within Basic, these routines allow you to Plot, Unplot, and Move individual shapes or groups of shapes on the Atom's screen in any of the graphic modes. By using the Atom's Colour command you can draw shapes in different colours or shades. You can also generate noises while these shapes are being drawn.

Anyone familiar with Basic and the need to handle large groups of numbers will have used arrays. These routines were developed with this in mind. By modifying the array elements

(continued on next page)

(continued from previous page)

assigned for shapes and then Linking to one of the machine-code routines you can create your own shapes and produce your own style games.

The following arrays are used in the routines. The XX array holds the X position of each shape, the YY array holds the Y position of each shape, the AA array holds the attributes of each shape, and the DD array holds the pixel-blocks of each shape.

You can have up to 256 shapes, memory permitting. To have 256 shapes would require 5K of RAM, but in practice 10 to 20 would normally be sufficient. The number of shapes you require is declared in a dimension statement.

To declare one shape for program use, type

```
10 DIM DD(1), AA(0), XX(0), YY(0)
```

Note that in Atom Basic element 0 is valid. I have used the term pixel blocks to describe the pixels that make up what is drawn. If you look closely at any normal character on the Atom, you will see that it is made up of small dots or pixels. The prompt is a good example. If you were to draw it on graph paper it would look like figure 6.

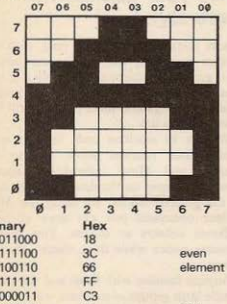
You can see that it is made up of 35 pixels arranged as five by seven, which is standard format. The pixels are arranged in a block, hence the term pixel block. Figure 1 is an example of a typical alien pixel block, in this case it is shown as eight by eight, that is, 64 pixels. These shape routines are based on this eight by eight block format and this is assumed in future references to pixel blocks.

A closer look at the numbers beneath figure 1, reveals that the pixel block can be described in eight bytes, one byte for each row, each bit of each byte representing a single pixel. To store this information in memory we will need two elements of an array; this is because each element of an array occupies four bytes of memory. To store the pixel block of one shape, Dimension for two elements of array DD, as in the previous example.

By way of example, put figure 1 into pixel block 0:

```
30 DD(0) = #FF663C18; REM EVEN ELEMENT
32 DD(1) = #C38181C3; REM ODD ELEMENT
```

Figure 1.



Binary	Hex	
00011000	18	
00111100	3C	even
01100110	66	element
11111111	FF	
11000011	C3	
10000001	81	odd
10000001	81	element
11000011	C3	

(listing continued from previous page)

```
 1120:VV25LDY @0;LDA (Z+
2),Y;AND @&20;BEQ VV26
 1130LDY @2;LDA (Z+2),Y;
JMP VV24
 1140:VV26 RTS
 1150\((
 1160\    THE BASIC MOVER
 1170\SAVE A
 1180:VV27 STA S+0
 1190\UNPLOT IT
 1200JSR VV24;LDA S+0
 1210\SET POINTERS
 1220:VV28JSR RR0
 1230\ADD X TO ARRAYX
 1240\LSB
 1250CLC;LDY@0;LDA(Z+6),
Y;ADC #339;STA (Z+6),Y
 1260\2ND
 1270INY;LDA (Z+6),Y;ADC
#354;STA (Z+6),Y
 1280\3RD
 1290INY;LDA (Z+6),Y;ADC
#36F;STA (Z+6),Y
 1300\4TH
 1310INY;LDA (Z+6),Y;ADC
#38A;STA (Z+6),Y
 1320\ADD Y TO ARRAY Y
 1330CLC;LDY @0;LDA(Z+4)
,Y;ADC #33A;STA (Z+4),Y
 1340INY;LDA (Z+4),Y;ADC
#355;STA (Z+4),Y
 1350INY;LDA (Z+4),Y;ADC
#370;STA (Z+4),Y
 1360INY;LDA (Z+4),Y;ADC
#38B;STA (Z+4),Y
 1370\CHECK RANGE
 1380LDA S+0;JSR RR2;BCS
VV29
 1390\OK
 1400JSR VV0
 1410\CHECK CHAIN
 1420:VV29LDY@0;LDA(Z+2)
,Y;AND @&20;BEQ VV30
 1430\ANOTHER
 1440LDY @2;LDA (Z+2),Y;
STA S+0;JMP VV28
 1450:VV30 RTS
 1460\( THE SHAPE DRAWER
 1470\YCOUNT=8
 1480:VV0 LDA @8;STA W
 1490\SET Y CO-ORDS
 1500LDA D+6;STA #5C;LDA
D+7;STA #5D
 1510\YSIC=YSIZE
 1520:VV1 LDA D+3;STA W+
1
 1530\DASVE
 1540:VV2 LDY W;DEY;LDA
(Z),Y;STA W+4
 1550\XCOUNT
 1560LDA @8;STA W+2
 1570\X CO-ORDS
 1580LDA D+4;STA #5A;LDA
D+5;STA #5B
 1590\XSIC=XSIZE
 1600:VV3 LDA D+2;STA W+
3
 1610:VV4 LDA W+4;STA W+
5;ROL W+5;BCS VV5
 1620LDA D+1;AND @3;STA
#5E
 1630\TRANS.?
 1640BIT D+1;BMI VV9;BPL
VV6
 1650\C-SET=FG
 1660:VV5 LDA D;AND @3;S
TA #5E
 1670\SNOW?
 1680:VV6 ;BIT D+1;BVC V
V8
 1690:VV7 BIT #B002;BMI
VV7
 1700\AT LAST PLOT IT
 1710:VV8 JSR VV14
 1720\INC X CO-ORDS
 1730:VV9 INC #5A;BNE VV
10;INC #5B
 1740\DEC. XSIC
 1750:VV10DEC W+3;BNE VV
4
 1760\ADJUST DSAVE
 1770ROL W+4
 1780\DEC XCOUNT
 1790DEC W+2;BNE VV3
 1800\SOUND?
 1810LDA D+1;AND @4;EOR
#B002;STA #B002
 1820\INC Y CO-ORDS
 1830INC #5C;BNE VV11;IN
C #5D
 1840\DEC. YSIC
 1850:VV11DEC W+1;BNE VV
2
 1860\DEC. YCOUNT
 1870DEC W;BNE VV1
 1880RTS
 1890\JMP TO PLOT
 1900:VV14 JMP (&3FE)
 1910\PLOT PIXEL-BLOCK
 1920\SET X CO-ORDS
 1930:VV15STX D+4;LDX @0
;STX D+5
 1940\SET Y CO-ORDS
 1950STY D+6;STX D+7
 1960\CLEAR MSB DP
 1970STX Z+1
 1980\SET STAT1
 1990INX;STX D
 2000\SET SIZE
 2010STX D+2;STX D+3
 2020\SET STAT2
 2030LDX @&C0;STX D+1
 2040\SET DP
 2050CLC;ROLA;ROL Z+1;RO
LA;ROL Z+1;ROLA;ROL Z+1
 2060ADC #2EF;STA Z
 2070LDA Z+1;ADC #30A;ST
A Z+1
 2080\NOW DO IT
 2090JMP VV0
 2100]
 2110@R.
```

Figure 2. Attribute register — four bytes.

MSB			LSB
Magnify	Chain shape	Pixel block	Status
M	C	N	S

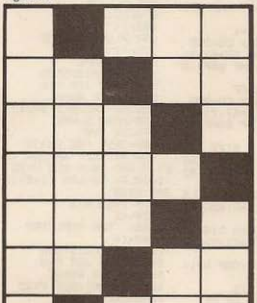
Figure 3. Status bits — eight bits.

MS Bit							LS Bit
Transparent	Snow	Chain	Fore ground		Sound	Back ground	
1	1	0	0	1	0	0	0
D7	D6	D5	D4	D3	D2	D1	D0

Figure 4. Magnify bits — eight bits.

X Magnify				Y Magnify			
0	0	0	0	0	0	0	0
D7	D6	D5	D4	D3	D2	D1	D0

Figure 6.



Note that for each element the order of the bytes is reversed; this is to compensate for method of storage of Atom Basic which stores numbers with the bytes reversed.

What is a shape? A pixel block is not a shape, merely the collection of pixels that make up a shape when it is drawn. A shape has position and certain attributes that define how it is drawn.

The position of a shape on the screen is held in its XX and YY array elements; their values contain its position relative to the origin, which is the bottom left-hand corner of the screen. This origin is the same as used by the Atom's plot commands, normally labelled 0,0.

For example set the shape co-ordinates at origin

```
20 XX(0) = 0;YY(0) = 0
```

Note that the values of XX and YY describe the position of the bottom left-hand corner of the shape.

A shape has various attributes which are held in its attribute register, an element of array AA. The format of the attribute register is shown in figure 2. Each byte of the attribute register has a different function and, as there are four bytes in the register, there are four functions.

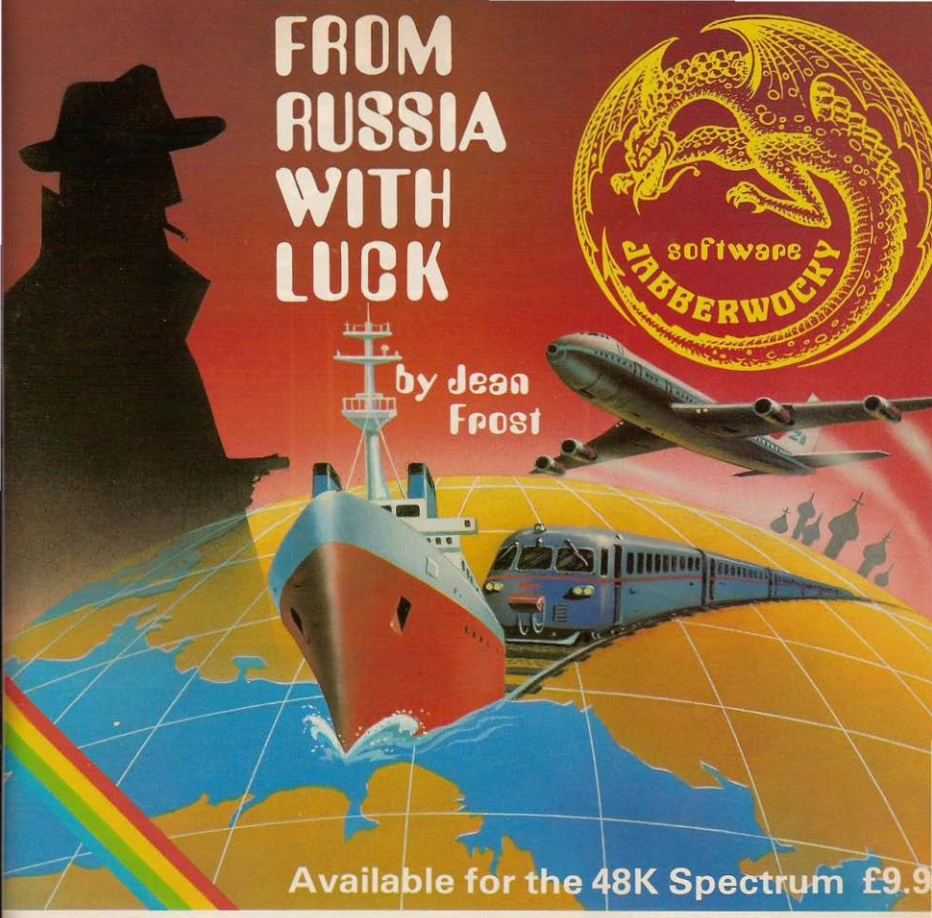
First, M — the most significant byte. The Mbyte is used by the machine-code routines to determine what size the shape will appear on the screen. In figure 4 the eight bits that make up the Mbyte are shown as they relate to X and Y magnification. If

```
M = 0
```

then the shape is drawn without magnification, each pixel of its pixel block covering one pixel on the screen. If

```
M = #11
```

(continued on page 127)



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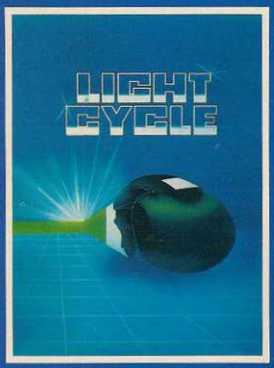

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(continued from page 122)

then the shape will be drawn twice size, each pixel of its pixel block covering four pixels on the screen. The shape can have a magnification factor of up to 15 either or both the X and Y directions. If

M = #F0

then the shape will be drawn normal height but 15 times as wide.

Secondly, C, the next byte, is used with the Chain bit of the status register to Chain shapes. If, say, shape 1 was Chained to shape 0 then whenever shape 1 was Plotted, Unplotted or Moved so too would shape 0. This is useful when you need to draw something with a pixel resolution greater than eight by eight, for example, for 16×8 two shapes Chained would be required. The value of C is the actual shape number that is Chained and can range from 0 to 255 — 0 to #FF. Third is N — the N byte is the number of the pixel block to be used when the shape is drawn. If N=0 then DD(0) and DD(1) will be used. Different shapes can have different or the same pixel blocks. The value of N can range from 0 to 255. Fourth is S — the least significant byte.

The status register is shown in expanded form by figure 3, the various bits having different functions.

Pixel bits that are not set in the pixel block 0 or unshaded in figure 1 can be transparent and will not be drawn with D7=1. Note that pixel bits that are set — binary 1 or shaded in figure 1 — are always drawn.

When data bit 6 is set to 1 screen drawing occurs only during flyback and hence will be interference free. Unfortunately this slows down the speed of drawing.

With data bit 5 equal to 1 followed by Chain the current operation is also applied to the shape given by C byte. Data bits 4 and 3 determine what the pixels that are set — binary 1 or shaded in figure 1 — in the pixel block do.

D4	D3	Function
0	0	Clear corresponding pixel on screen
0	1	Set corresponding pixel on screen
1	0	Invert corresponding pixel on screen
1	1	Clear corresponding pixel on screen

With data bit 2 — Sound = equal to 1, the Atom speaker part bit will be toggled — or changed — every time a pixel is drawn.

Data bits 1 and 0 determine what the pixels that are clear — binary 0 or unshaded squares in figure 1 — in the pixel block do:

D1	D0	Function
0	0	Clear corresponding pixel on screen
0	1	Set corresponding pixel on screen
1	0	Invert corresponding pixel on screen
1	1	Clear corresponding pixel on screen

Here is an example: set the shape attributes for normal size, pixel block 0, transparency, snow free, no Chain, no Sound, foreground set, background clear:

M=0, D=0, C=0, S=#C3 (Binary 11001000) comes out as:

40 AA(0) = #000000C8

What can you do with shapes and pixel blocks? See figure 5. The address of each machine-code routine is given, together with what the Basic variables A, X and Y should contain. For the Plot-a-shape routine referred to at the top of figure 5, set arrays AA, DD, XX and YY as required. Put the shape number in Basic variable A then Link to #2920. For example, Plot a shape in mode 4.

5 Clear 4
50 A=0;LINK#2920

To Unplot a previously drawn shape it is important to remember that this can only be done provided it has the transparency bit set in its status register and the background bits are assigned clear. In graphic modes with only two colours the background bits may be assigned inverter clear. Put the shape number in Basic variable A then Link to #2923. So, to Unplot shape 0

55 A=0; LINK#2923

Now for the Move a shape routine. A previously-drawn shape may be moved — Unplotted then Plotted in a new position — provided its attributes comply with the previous example. The new position is relative to its old position by the contents of Basic variables X and Y. Put the shape number in variable A and the distances to be moved horizontally and vertically into variables X and Y respectively then Link#2926.

For example to Move shape 0 up 10 and right 20

70Y=10; X=20; A=0; LINK#2926

Note that X and Y can be positive or negative and XX and YY arrays will be updated to the new position.

For the first Plot a pixel block option, your pixel block will be plotted without magnification at the position contained in Basic variables X and Y. Put the pixel-block number in variable A, and the actual position horizontally and vertically into X and Y respectively, then Link to #2929. Thus to Plot pixel block 1 at 10, 10

90 X=10; Y=10; A=1; LINK#2929

Finally, the demonstration program draws shapes on the screen and moves them about, showing what can be achieved with the Shapes program.

Later it allows you to define your own shapes which can be manipulated on-screen using simple commands. ■

Figure 5. Table of Link Addresses.

Operation	Address: Source	Address: Compiled	Variables: A	Variables: X	Variables: Y
Plot a shape	M+0	#2920	Shape number		
Unplot a shape	M+3	#2923	Shape number		
Move a shape	M+6	#2920	Shape number	X-direction	Y-direction
Plot a pixel block	M+1	#2929	Block number	X position	Y position

The demonstration program.

```
  10DIM DD(19),AA(9),YY
(9),XX(9),F(3)
  20P.$30;CLEAR0
  30P."demostration"
  40P."YOU CAN DRAW A
SHAPE"
  50REM**SET PIXEL BLOC
K**
  60DD(0)=#AA55AA55;DD(
1)=#AA55AA55
  70REM**SET CO-ORDINAT
ES
  80XX(0)=10;YY(0)=10
  90REM**SET ATTRIBUTES
  100AA(0)=#C8
  110REM DRAW IT
  120A=0;LINK#2920
  130GOS.820
  140GOS.870;P."YOU CAN
RUB IT OUT"
  150A=0;LINK#2923
  160GOS.820
  170REM MOVE IT
  180GOS.870;P."YOU CAN
MOVE IT"
  190REM RESET CO-ORDS
  200XX(0)=0;YY(0)=0
  210REM DRAW IT
  220X=1;Y=1;A=0;LINK#29
20
  230REM NOW MOVE IT
  240FOR I=0 TO 30
  250LINK#2926
  260NEXT I
  270GOS.820
  280REM MAGNIFY
  290GOS.870;P."AND YOU
CAN CHANGE THE SIZE"
  300REM FIRST RUB OUT
  310A=0;LINK #2923
  320REM NOW DO IT
  330AA(0)=#48;XX(0)=0;Y
Y(0)=0
  340FOR I=0 TO 4
  350LINK#2920
  360AA(0)=AA(0)+#110000
00
  370NEXT I
  380GOS.820
  390CLEAR0;GOS.870;P."A
ND YOU CAN CHAIN THEM"
  400REM PIXEL INVADDERS
  410DD(2)=#FF663C18;DD(
3)=#C38181C3
  420REM SET CO.ORDS
  430FOR I=1 TO 5;YY(I)=
0;XX(I)=I*10-10;N.I
  440REM SET CHAINS
  450AA(1)=#18C;AA(2)=#0
101AC;AA(3)=#201AC;AA(4)
=#301AC
  460AA(5)=#401AC
  470REM MOVE THEM
  480X=0;Y=5;A=5;LINK#29
20
  490FOR I=0 TO 5
  500LINK#2926
  510NEXT I
  520GOS.820
  530REM NOW SHOOT THEM
  540REMDEFINE TANK
  550DD(4)=0;DD(5)=#7F3E
1C08
  560AA(6)=#2CC
  570XX(6)=0;YY(6)=0
  580REM SHOOT THEM
  590A=6;LINK#2920
  600Y=0;X=1
  610FORI=0 TO XX(5)
  620IF XX(6)=XX(1);GOS.
840;A=1;LINK#2923
  630A=6;LINK#2926
  640IF XX(6)=XX(2);GOS.
840;A=2;LINK#2923
  650IF XX(6)=XX(3);GOS.
840;A=3;LINK#2923
  660IF XX(6)=XX(4);GOS.
840;A=4;LINK#2923
  670IF XX(6)=XX(5);GOS.
840;A=5;LINK#2923
  680N.I;GOS.820
  690CLEAR0;GOS.870;P."N
OW YOU TRY";GOS.820
  700P.'''TYPE ;"
  710P.'"    P    TO PLOT
"
  720P.'"    R    TO RUBO
UT"
  730P.'"    M    TO MOVE
"
  740P.'"    C    TO CLEA
R SCREEN"
  750P.'"    A    TO CHAN
GE ARRAYS"
  760P.'"PLUS RETURN"
  770P.'''YOU HAVE 10 SH
APES BUT 0-6 ARE  ALREAD
Y USED"
  780P.'''PRESS A KEY TO
CONTINUE";LINK#FE94
  790CLEAR0
  800G.900
  810REM DELAY 3 SECS
  820FORI=0 TO 100;WAIT;
WAIT;NEXT I;R.
  830REM PLOT LASER
  840L=XX(6)+4;MOVE L,4;
PLOT6 L,40;P.$7
  850MOVE L,4;PLOT6 L,40
;R.
  860REM CLEAR TOP 3 LIN
ES
  870P.$30;FOR I=0 TO 63
;I?#8000=32;N.I;R.
  880GOS.870;IN."SHAPE N
UMBER";S;IF S<0 OR S>10 G
880
  890R.
  900GOS.870;IN."YOUR CO
MMAND"$F
  920IF $F="C";CLEAR 0;G
.900
  930IF $F="P";GOS.880;A
=S;LINK#2920;G.900
  940IF $F="R";GOS.880;A
=S;LINK#2923;G.900
  950IF $F="M"G.970
  960G.1010
  970GOS.880;A=S
  980GOS.870;IN."X DIREC
TION"X
  990GOS.870;IN."Y DIREC
TION"Y
  1000LINK#2926;G.900
  1010IF $F="A"G.1030
  1020G.900
  1030GOS.880
  1040GOS.870;P."AA ,XX ,
YY OR DD or EXIT"
  1050INPUT $F
  1060IF $F="E"G.900
  1070IF $F="A";GOS.870;P
."AA="&AA(S);IN.N;AA(S)=
N;G.1040
  1080IF $F="X";GOS.870;P
."XX="&XX(S);IN.N;XX(S)=
N;G.1040
  1090IF $F="Y";GOS.870;P
."YY="&YY(S);IN.N;YY(S)=
N;G.1040
  1100IF $F="D"G.1120
  1110G.1040
  1120GOS.870;P."EVEN ELE
MENT"&DD(S*2);IN.N;DD(S*
2)=N
  1130GOS.870;P."ODD ELEM
ENT"&DD(S*2+1);IN.N;DD(S
*2+1)=N
  1140G.1040
```

ATARI

```
10 REM ######################
11 REM ##    TIME TRIAL    ##
20 REM ##  BY STAN OCKERS  ##
30 REM ######################
40 REM ## ALL REMS CAN BE DELETED ##
100 DIM M$(32),S$(8),P$(8),T(5):OPEN #1,4,0,"K:"
150 REM ## NEW CHARACTER SET ##
155 REM ## ML routine for moving 1K ##
160 FOR I=1 TO 32:READ A:M$(I)=CHR$(A):NEXT I
170 DATA 104,104,133,204,104,133,203,104,133,206,104,133,205,162,4,160,0,177,203,145,205,136,208
,249,230,204
175 DATA 230,206,202,208,240,96
177 REM ## Lower RAMTOP and move character set ##
180 POKE 106,PEEK(106)-5:GRAPHICS 0:CS=(PEEK(106)+1)*256:A=USR(ADR(M$),57344,CS)
185 REM ## Change a couple of characters (% and I) ##
190 FOR I=CS+32 TO CS+47:READ A:POKE I,A:NEXT I
195 DATA 36,109,73,146,146,73,109,36,182,146,73,73,146,182,36
200 REM ## NEW DISPLAY LIST ##
210 GRAPHICS 18:DL=PEEK(560)+256*PEEK(561):A=PEEK(DL+4)+256*PEEK(DL+5):A=A+22:B=INT(A/256):C=A-B
*256
220 POKE DL+4,C:POKE 88,C:POKE DL+5,B:POKE 89,B:POKE DL+6,6:POKE DL+7,6
230 FOR I=17 TO 19:POKE DL+I+21,PEEK(DL+I):NEXT I
240 FOR I=DL+8 TO DL+35 STEP 3:POKE I,103:POKE I+1,146:POKE I+2,6:NEXT I:POKE DL+35,71
245 POKE 756,CS/256:POKE 708,200:POSITION 4,0:? #6;"INITIALIZING"
250 REM ## DATA FOR ROADWAY ##
252 REM ## Try making your own ##
255 RESTORE 265
260 RW=(PEEK(106)-10)*256:FOR I=RW TO RW+512:READ A:A=A+141:POKE I,A:NEXT I
265 DATA 25,5,5,5,5,5,5,5,5,4,4,4,4,3,3,3,3,2,2,2,2,1,1,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0
267 DATA 1,1,1,1,1,1,2,2,2,2,2,2,3,3,3,3,3,3,4,4,4,4,4,4,5,5,5,5,5,5,6,6,6,6,6,6,7,7,7,7,7,7,7
,7,8,8,8,8
270 DATA 8,8,8,8,9,9,9,9,10,10,10,10,9,9,9,9,8,7,6,5,4,3,2,1,0,1,2,3,4,5,6,7,8,9,9,9,9,8,8,8,7
,7,6,6,5
275 DATA 5,6,6,7,7,8,8,9,9,8,8,8,8,7,7,7,7,6,6,6,6,5,5,5,5,4,4,4,4,3,3,2,2,1,1,0,0,1,1,2,2
,3,3,4,4,5
277 DATA 5,6,6,7,7,8,8,9,9,8,7,6,5,4,3,2,1,0,0,0,1,2,3,4,5,6,7,8,9,9,9,9,9,9,8,7,6,5,4,3,2,1,1
,1,0,0,0,0
280 DATA 0,0,0,0,0,0,0,0,0,1,1,1,2,2,2,3,3,3,4,4,4,5,5,5,6,6,6,7,7,7,8,8,8,9,9,9,9,9,9,9,9,9,9
,9,9,9,9
282 DATA 8,8,8,7,7,6,6,5,5,4,4,3,3,2,2,1,2,1,1,2,2,1,1,3,3,3,4,5,6,7,8,9,8,7,6,5,4,3,2,1,1,1
,1,1,1,1
285 DATA 2,2,2,3,3,3,3,4,4,4,4,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,6,6,6,6,6,6,7,7,7,7,7,7,8,8,8,8
,7,7,6,6,5
287 DATA 5,5,6,6,6,7,8,9,8,7,6,5,5,5,5,5,4,3,2,1,1,2,3,4,5,6,7,8,9,9,8,7,6,5,4,3,2,1,2,3,4,5
,6,7,8,9,8
288 DATA 7,7,6,6,5,5,4,4,3,3,2,2,1,1,2,2,3,3,3,4,4,4,5,5,5,6,6,7,7,8,8,9,9,8,8,8,8,7,7,6,6,6,5
,5,5,5,5,5
290 DATA 5,5,5,4,3,2,1,2,3,4,5,5,5,5,5,5,5,5,5,5,5,5,5,5,114
300 REM ## PAGE SIX POKES ##
310 RESTORE 315:FOR I=1536 TO 1731:READ A:POKE I,A:NEXT I
314 REM ## Change VBI vector ##
315 DATA 104,160,17,162,6,169,7,76,92,228
316 REM ## Init. data for VBI routine ##
317 DATA 1,1,0,0,0,0,0
318 REM ## VERT BLANK ROUTINE ## Determine scroll value ##
319 DATA 206,11,6,208,94,173,10,6,141,11,6
320 DATA 173,12,6,206,16,6,74,176,250,173,16,6,141,5,212,16,71
321 REM ## Move lines down ##
322 DATA 169,16,141,16,6,173,48,2,133,203
325 DATA 56,233,3,133,205,173,49,2,133,204,133,206,160,37,177,205,145,203,136,177,205,145,203,13
6,136
330 DATA 192,10,208,241
331 REM ## Add a new line ##
332 DATA 230,207,208,2,230,208,162,0,161,207,201,255,208,15,173,14,6,133,207
333 DATA 173,15,6,133,208,161,207,238,13,6,136,145,203
335 DATA 173,0,211,72,41,8,208,2,230,209,104,41,4,208,2,198,209,165,209,141,0,208,76,98,228
338 REM ## Screen roadway data ##
340 DATA 4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5,4,5
,4
342 REM ## Remove our VBI routine ##
343 DATA 104,160,98,162,228,169,7,76,92,228
344 REM ## POS. AT BEG. OF RW DATA ##
345 POKE 1550,0:POKE 1551,RW/256:POKE 207,0:POKE 208,RW/256
350 REM ## ROADWAY WIDTH ##
358 POSITION 0,0:? #6;"                                    "
360 POSITION 0,1:? #6;"ROAD WIDTH (1)NARROW TO (3) WIDE      ";GET #1,A:W=A-48:IF W<1 OR W>3 T
HEN 360
370 FOR I=1690-W TO 1693+W:POKE I,0:NEXT I:FOR I=1710-W TO 1713+W:POKE I,222:NEXT I
400 REM ## PM GRAPHICS ##
410 A=PEEK(106)-7:POKE 54279,A:PM=256*A:POKE 559,46:POKE 53277,3:X=120:POKE 53248,X:POKE 209,X:P
OKE 53256,1
415 RESTORE 430
420 FOR I=PM+512 TO PM+640:POKE I,0:NEXT I:POKE 704,56:Y=90:FOR I=PM+512+Y TO PM+528+Y:READ A:PO
KE I,A:NEXT I
430 DATA 153,153,255,153,153,24,24,60,36,36,36,36,165,165,231,189,153
440 FOR I=1 TO 8:READ A:P$(I,I)=CHR$(A):NEXT I
450 DATA 106,96,85,76,63,51,40,22
490 POSITION 0,1:? #6;"PRESS FIRE BUTTON   WHEN READY TO START"
492 IF STRIG(0)=1 THEN 492
495 A=USR(1536)
500 REM
502 POSITION 0,1:? #6;"TOTAL        LAP    ";POSITION 0,2:? #6;" AVG. SPEED AVG. LAP"
504 REM ## RESET CLOCK - INIT. VAR. ##
505 Z=0:POKE 18,Z:POKE 19,Z:POKE 20,Z:LAP=0:T(0)=0:DIST=220000:DIS=12
507 REM ## SPEED BYTES STRING ##
510 RESTORE 520:FOR I=1 TO 8:READ A:S$(I)=CHR$(A):NEXT I:N=1:TT=30
520 DATA 0,1,3,7,15,31,63,127
522 REM ## CK TRIGGER - CLEAR COLL. REG. ##
525 T=STRIG(0):POKE 53278,0
530 REM ## TT IS ACCELERATOR RESPONSE COUNTER ##
531 TT=TT-1:IF TT>0 THEN 560
532 TT=30
533 IF T=1 AND N=1 THEN 560
536 IF T=0 AND N=8 THEN 560
540 IF T=1 THEN N=N-1:IF N=0 THEN N=8
550 IF T=0 THEN N=N+1:IF N=9 THEN N=1
555 REM ## SET SPEED ##
560 POKE 1548,ASC(S$(N,N))
570 L=PEEK(1549):IF L>LAP THEN GOSUB 2010
572 IF L<5 THEN 610
573 REM ## COLLISION DETECTION ##
575 IF PEEK(53252)=1 THEN GOSUB 1010
577 REM ## PRINT SPEED - MOTOR SOUND ##
580 POSITION 7,0:? #6;204N;" "
582 IF DIS=12 THEN DIS=2:GOTO 584
583 IF DIS=2 THEN DIS=12
584 SOUND 0,ASC(P$(N,N)),DIS,7+N
590 GOTO 525
600 REM ## FINISH ROUTINE ##
610 SOUND 0,0,0,0:A=USR(1722)
620 POSITION 0,0:? #6;"AVG. = ";INT(TS);"
630 IF TS>RA THEN RA=TS
640 POSITION 0,1:? #6;"RECORD = ";INT(RA);"
650 POSITION 0,2:? #6;"Again? Press Trigger"
655 IF STRIG(0)=0 THEN 655
660 IF STRIG(0)=1 THEN 660
670 GOTO 310
1000 REM ## COLLISION SUBROUTINE ##
1010 FOR I=0 TO 3:SOUND I,50+20*I,2*I+2,
     12:NEXT I
1020 FOR I=N TO 1 STEP -1
1030 N=I:POKE 1548,ASC(S$(N,N)):POKE 712,
     N*16+8:POKE 704,N*16+10:FOR J=1 TO
     10:NEXT J:NEXT I
1090 POKE 704,56:POKE 712,0:FOR I=0 TO 3:SOUND
     I,0,0,0:NEXT I:RETURN
2000 REM ## NEW LAP SUBROUTINE ##
2005 REM ## Ck. clock for lap time - calc.
     speed ##
2010 LAP=L:T(LAP)=PEEK(20)+256*PEEK(19)+256*
     256*PEEK(18):SP=DIST/(T(LAP)-T(LAP-1))
2020 POSITION 12,0:? #6;INT(SP);"   ";TS=DIST
     *LAP/(T(LAP)-T(0)):POSITION 1,0:?
     #6;INT(TS);" "
2025 POSITION 18,0:? #6;LAP
2030 RETURN
```

CS = display list
DL = display list
RW = road way
VBI = vertical blank interrupt
W = width of road
T = trigger fire button
TT = trigger total — accelerator

TIME TRIAL is a machine-language program: it moves the road while a Basic program creates sounds and checks collisions. The machine-language program runs during the time that the electron beam in the TV tube is returning from bottom to the top of the screen, which is referred to as the "vertical blank" period.

Basic is normally interrupted during this time for the operating system to do certain updating chores. There is also plenty of time for our scrolling program. Because the screen is blanked at this time the updating will not cause flickering.

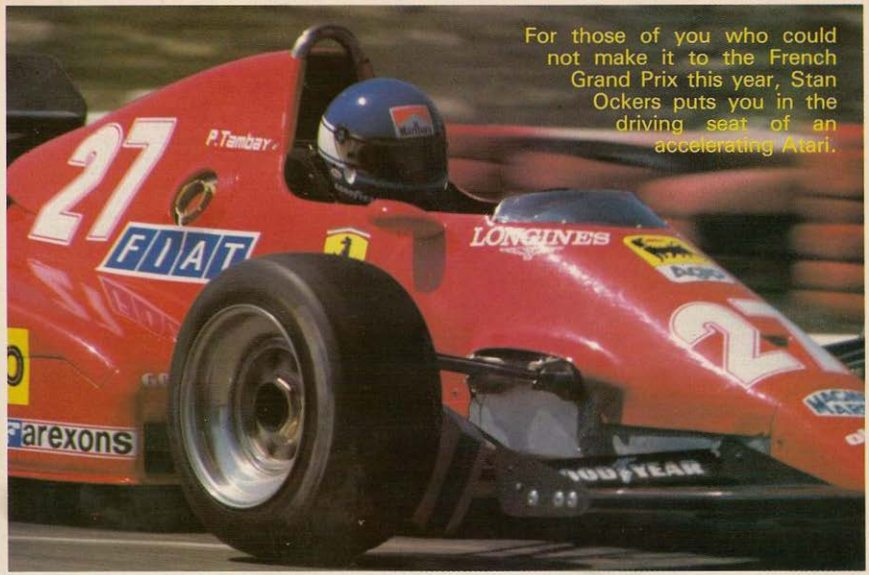
The key to scrolling is the display list and in particular the LMS instruction — Load Memory Scan. The display list is a set of instructions for Antic, the microprocessor which controls the screen. The display list for GR 18 is given in table 1. The LMS instructions point to the area in memory where screen data resides. The instructions following are single byte because they just continue picking up data where the last line left off.

The revised display list appears in table 2. Each line of characters in the scrolled region has its own LMS instruction. This allows using portions of the same data for many lines — the starting position is displaced. A display list similar to table 1 with scrolling activated could be used, but the data would have to be a continuous chunk of memory. Thus 512 roadway lines would require

$$512 \times 20 = 10{,}240$$

bytes of data. A lot more variation and detail would be available but that is a lot of memory.

NOTES
LINE 358 CONTAINS 20 BLANK SPACES
END OF LINE 620 HAS 11 BLANKS
END OF LINE 640 HAS 9 BLANKS



For those of you who could not make it to the French Grand Prix this year, Stan Ockers puts you in the driving seat of an accelerating Atari.

TIME TRIAL RUN

In lines 150-195 a new character set is constructed to get just two new characters. The whole character set is moved down into RAM. Doing this in Basic takes over 20 seconds so here a machine-language routine stored in M$ does it. Calling is by

A=USR(ADR(M$), ADDR1, ADDR2)

for moving 1K from Addr1 to Addr2. The machine-language routine takes less than a couple of seconds. RAMtop is moved down five pages to make room for the character set. Basic thinks RAM stops five pages lower. The extra page is because Basic will actually alter a few bytes beyond RAMtop if they exist — normally they do not.

After creating the new display list and Poking in data for the roadway, the vertical blank routine is Poked into page 6. The routine communicates with Basic through a set of locations listed in table 3. The routine does a number of things. The number indicating how much of a character is scrolled changes from 16 down to 0. It is then reset to 16, each LMS pointer is shifted down into the next LMS pointer — moving all lines down screen, and the LMS pointer for the top line is set by referring to the next roadway data byte.

If the byte is 255, the pointer is set by returning back to the beginning of the roadway data. Notice that is necessary to use machine language to insert or remove our VBI routine. In Basic an interrupt could occur between changing the low and high bytes of the pointer resulting in a disastrous jump. The OS provides a routine at &E45C to solve this problem.

How rapidly scrolling takes place would normally be determined by the byte at 1546 — Count — which resets a counter — CNTDN — at 1547. This turned out to be much too slow so a one was placed in Count and some scrolling takes place every time through. To go even faster, some positions between 16 and 0 are skipped. The number of positions skipped is found by shifting the byte at 1548 right until a 0 bit is found. The number in 1548 then controls the speed — Poked in at line 560 in the Basic program.

The car is a PM graphics player set up in lines 400-430. The seven additional pages down from RAMtop put the start of PM area on a 1K boundary as it must be. Even though horizontal movement requires only a Poke of one location, it proved to be slow and jerky in Basic. The solution was to put this function into the vertical blank routine where it is updated every 0.016 seconds.

The point of the program is to move the car around the track of five laps as fast as possible. The fire button — joystick player 1 — is the accelerator, down to speed up, and up to slow down. Going off track will slow you down.

Table 1. Original display list.

DL+	Entry	Purpose
0-2	112'S	Blank lines
3-5	71 xx xx	LMS to point to display data
6-16	7's	11 more lines, 16 scan lines wide
17-19	65 yy yy	JMP to DL after wait for VB

Table 2. Revised display list

DL+	Entry	Purpose
0-2	112's	Blank lines
3-5	71 zz zz	LMS pointer moved up 21 bytes
6-7	6's	2 lines 8 scan lines wide
8-10	103 aa aa	LMS points to data in page 6 (9 sets total)
32-34	103 aa aa	
35-37	71 aa aa	LMS as before but without Vscroll
38-40	65 yy yy	JMP to DL after wait

Table 3.

1546 060A	Count
47 060B	CNTDN
1548 060C	Skip Char, lines skipped
1549 060D	Times Lap counter
1550 060E	Low, Low-byte roadway pointer
551 060F	High High-byte roadway pointer
1552 0610	VShadow copy of VScroll

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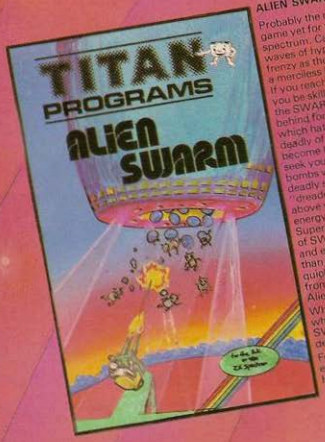

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When you are eventually overwhelmed how many of the SWARM will you have destroyed?

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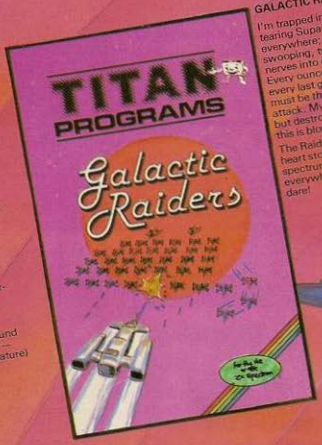

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I'm trapped in a brain tearing Supanova. They're everywhere, screaming, swooping, twisting my nerves into oblivion. Every ounce of energy, every last gasping breath must be thrust into my final attack. My lazer base is all but destroyed, I can't go on, this is blowing my mind!

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With stunning Graphic display of mountains, golden beaches and deep blue seas, you are assigned to attack a vehicle convoy. Your on board gun has a quite unique sight which allows you to destroy your target with incredible precision. A totally addictive game that will leave you trembling with excitement.

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Once there was Invaders, then Packmen, now there's Space Hopper. Can you guide your Space Frog through the hustle and bustle of space traffic without being crushed by intergalactic space trains? Can you avoid being shot by hidden laser guns and are you able to hop through the space warp. If you think you can order it today!

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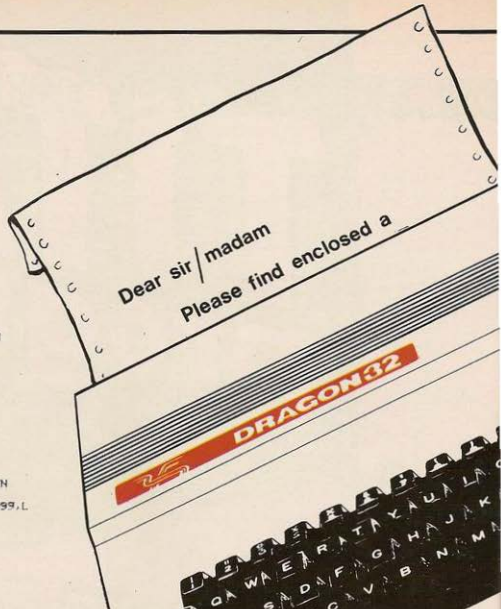
```
10 POKE5992,23:POKE5993,111
20 GOSUB2000
100 Q$=INKEY$:IFQ$<>""THENCLS
105 IFQ$="S"THENGOSUB1600
110 IFQ$="I"THENGOSUB1400
120 IFQ$="D"THENGOSUB1200
130 IFQ$="T"THENGOSUB1000
140 IFQ$="P"THENGOSUB600
150 IFQ$="C"THENGOSUB200
160 IFQ$="O"THENGOSUB800
170 IFQ$="M"THENGOSUB1800
180 IFQ$="H"THENGOSUB2000
190 IFQ$="W"THENGOSUB2200
195 IFQ$="Z"THENGOSUB2600
199 GOTO100
200 INPUT"CERTAIN (Y)";A$
210 IF A$="Y" THEN EXEC5966
220 RETURN
400 H=JOYSTK(0):V=JOYSTK(1)
410 H=H/2:V=INT(V/4)
420 CU=(1024+32*V+H):POKECU,159
430 CA=6000+(SC-1)*512+CU-1024
440 POKE5990,INT(CA/256):POKE5991,CA-(PEEK(5990)*256)
445 GOSUB1610
447 L1=256*PEEK(5992)+PEEK(5993)
450 IF INKEY$="R" THEN RETURN ELSE GOTO 400
600 INPUT"START PRINTING AT BEGINNING OF  SCREEN NO.:";N
605 N=6000+512*(N-1)
610 POKE5982,INT(N/256):POKE5983,N-(PEEK(5982)*256)
620 INPUT"NUMBER OF SCREENS I SHOULD PRINT:";N
630 POKE5984,N*2:POKE5985,0
640 EXEC5657
650 RETURN
800 FR=1:PRINT"OVERWRITE":GOSUB1000
810 GOSUB1600:GOSUB400:IF CA>=LI THENGOSUB2400:RETURN
820 EXEC5941
830 FR=0:A$="":RETURN
1000 A$="":LINE INPUT "TEXT:";A$
1005 IF A$="" THEN 1000
1010 L=LEN(A$):IF L>160 THEN PRINT:PRINT"TOO LONG":RETURN
1020 A=VARPTR(A$)+2:B=VARPTR(A$)+3
1030 POKE5986,PEEK(A):POKE5987,PEEK(B):POKE5988,0:POKE5989,L
1035 IF FR=1 THEN RETURN
1040 EXEC5736
1050 RETURN
1200 INPUT"NUMBER TO DELETE";N:IFN=0 THEN N=1
1205 GOSUB1600
1210 POKE5998,INT(N/256):POKE5999,N-(PEEK(5998)*256)
1220 GOSUB400
1225 IF CA>=LI THEN GOSUB2400:RETURN
1226 IF N>=(CA-6000) THEN GOSUB2400:RETURN
1230 EXEC5837
1240 RETURN
1400 FR=1:PRINT"INSERT":GOSUB1000
1410 GOSUB1600:GOSUB400:IF LI<=CA THEN GOSUB2400:RETURN
1420 EXEC5772
1430 POKE5998,0:POKE5999,L:EXEC5941
1440 FR=0:A$="":RETURN
1600 INPUT"SCREEN";SC:IFSC=0 THEN SC=1
1610 SP=6000+(SC-1)*512:POKE5988,INT(SP/256):POKE5989,SP-(PEEK(5988)*256)
1620 EXEC5588
1650 RETURN
1800 INPUT"MOVE HOW MANY:";N
1810 POKE5998,INT(N/256):POKE5999,N-(PEEK(5998)*256)
1820 PRINT"SET CURSOR FOR SOURCE":GOSUB1600:GOSUB400
1830 POKE5996,PEEK(5990):POKE5997,PEEK(5991):CLS
1840 PRINT"SET CURSOR FOR DESTINATION":GOSUB1600:GOSUB400
1850 POKE5994,PEEK(5990):POKE5995,PEEK(5991)
1860 EXEC5916
1870 RETURN
2000 CLS
2010 PRINT"C TO CLEAR MEMORY":PRINT"T TO LOAD TEXT":PRINT"P TO PRINT OUT":PRINT"
S TO DISPLAY":PRINT"W FOR CURRENT SCREEN":PRINT"I TO INSERT":PRINT"D TO DELETE":
PRINT"M TO MOVE BLOCK":PRINT"O TO OVERWRITE":PRINT"H FOR HELP":PRINT"Z FOR CODE"
2020 PRINT:PRINT"R TO RETURN FROM CURSOR"
2030 RETURN
2200 IF SC=0 THEN SC=1
2210 GOSUB1610
2220 RETURN
2400 CLS:PRINT"YOU CAN'T":RETURN
2600 INPUT"CODE:";C:A$=CHR$(C)
2610 FR=1:GOSUB1010:FR=0
2620 GOSUB810:A$="":RETURN
```

This is the alternative listing for lines 400-650 for controlling the cursor with the arrow keys. Please note that it is necessary to alter the Printer Prompts in lines 600 and 620 as shown to fit this substitute routine into available memory.

```
400 Q$=INKEY$:IFQ$=""ANDV>0THENV=V-1
405 IFQ$=CHR$(10)ANDV<15THENV=V+1
410 IFQ$=CHR$(9)ANDH<31THENH=H+1
415 IFQ$=CHR$(8)ANDH>0THENH=H-1
420 CU=(1024+32*V+H):POKECU,159
430 CA=6000+(SC-1)*512+CU-1024
440 POKE5990,INT(CA/256):POKE5991,CA-(PEEK(5990)*256)
445 GOSUB1610
447 L1=256*PEEK(5992)+PEEK(5993)
450 IFQ$="R"THENRETURNELSE400
600 INPUT"BEGIN SCREEN:";N
605 N=6000+512*(N-1)
610 POKE5982,INT(N/256):POKE5983,N-(PEEK(5982)*256)
620 INPUT"# OF SCREENS:";N
630 POKE5984,N*2:POKE5985,0
640 EXEC5657
650 RETURN
```



Disassembled listing of the machine code.

```
00100          ORG   5588
00110 COUNT    EQU   5998
00120 SOURCE   EQU   5996
00130 DESTIN   EQU   5994
00140 LIMIT    EQU   5992
00150 CADDR    EQU   5990
00160 SSTART   EQU   5988
00170 TSTART   EQU   5986
00180 PCOUNT   EQU   5984
```

(listing continued on page 139)

DRAGON WORD PROCESSOR

The real keyboard on the Dragon just begs to be used with a word processor. With John Nash's software it need beg no more.

THIS SIMPLE word-processor program for the Dragon 32 provides the following functions: text load, display and print; insert, delete and overwrite; code input and block-move; double-size, new line and paragraph.

The program has been designed to leave the maximum available memory, so further refinements were not included. It leaves the addresses from 6000 decimal. to the top of memory clear, allowing storage of 26,768 characters, say 5-6,000 words.

Put in the machine code first. Either use a machine-code assembler, or input the decimal codes directly from a data statement. In either case, the code should be loaded from 5588 decimal. After this, save the code on to tape — CSaveM — type PClear1, and load the Basic program. Please do not add any spaces or Rems as memory is very tight. When the program is running, less than 250 bytes are left for the Basic system. Finally, save the Basic on to tape. This is the procedure to follow for first-time loading. For subsequent loading, type PClear1, load the Basic program, then load the machine code. Before running, type

CLEAR192,5588

to set the system limit.

When using the word processor, the program allows the input of lower case using the Shift0 convention. For double size use the up-arrow to open, and Shift up-arrow to close. New lines are put in with the Shift down-arrow key, while paragraphs are available on the Shift right-arrow key. Be careful to change back to upper case at the end of a line before entry, because the program will accept key commands only in upper case. It will not crash with a lower-case command, but you will get a blank screen, and have to type Shift0 before the program will respond.

To start the program, type Run. This starts storing from 6000. If you need to Break, restart with Goto 100 to continued from the current location, as Run will always re-initialise. The program will display a menu initially, and if H is pressed while running. Pressing T allows the storing of text in the memory, up to five lines or 160 characters at a time. The S key will display a screen of text, asking which one you want. Also included is a quick command, W, which displays the screen most recently requested.

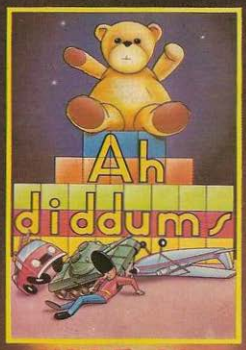
The I key will insert text under cursor control, asking for the text, screen and

(continued on page 139)

The decimal codes.

```
5588  142  4  0  16  190  23  100  206
5596  2  0  166  160  129  32  39  45
5604  129  33  39  41  129  39  39  37
5612  129  44  39  33  129  46  39  29
5620  129  58  39  25  129  59  39  21
5628  129  63  39  17  129  97  36  17
5636  167  128  51  95  17  131  0  0
5644  39  2  32  206  57  139  64  32
5652  239  128  96  32  235  254  23  96
5660  190  23  94  166  128  129  93  39
5668  38  129  91  39  30  129  94  39
5676  18  129  95  39  18  189  128  15
5684  51  95  17  131  0  0  39  2
5692  32  225  57  134  14  32  238  134
5700  15  32  234  134  10  32  230  134
5708  10  189  128  15  134  32  189  128
5716  15  134  32  189  128  15  134  32
5724  189  128  15  134  32  189  128  15
5732  134  32  32  201  254  23  110  190
5740  23  104  252  23  104  243  23  110
5748  253  23  104  48  1  16  190  23
5756  98  166  160  167  128  51  95  17
5764  131  0  0  39  2  32  242  57
5772  252  23  104  179  23  102  31  3
5780  51  65  190  23  104  252  23  104
5788  195  0  1  253  23  104  16  190
5796  23  104  48  1  49  33  166  130
5804  167  162  51  95  17  131  0  0
5812  39  2  32  242  252  23  110  131
5820  0  1  253  23  110  204  0  0
5828  16  179  23  110  39  2  32  192
5836  57  252  23  102  195  0  1  253
5844  23  102  252  23  104  179  23  102
5852  31  3  51  66  252  23  104  131
5860  0  1  253  23  104  190  23  102
5868  252  23  102  131  0  1  253  23
5876  102  16  190  23  102  166  128  167
5884  160  51  95  17  131  0  0  39
5892  2  32  242  252  23  110  131  0
5900  1  253  23  110  204  0  0  16
5908  179  23  110  39  2  32  187  57
5916  254  23  110  190  23  108  16  190
5924  23  106  166  128  167  160  51  95
5932  17  131  0  0  39  2  32  242
5940  57  254  23  110  190  23  102  16
5948  190  23  98  166  160  167  128  51
5956  95  17  131  0  0  39  2  32
5964  242  57  142  23  112  134  32  167
5972  128  140  127  255  36  2  32  247
5980  57  0  23  112  2  0  21  179
```

How are yours



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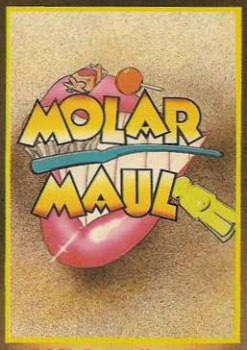

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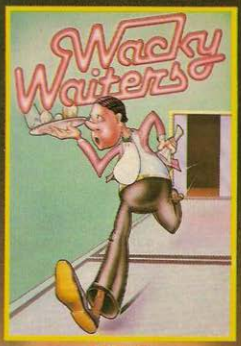

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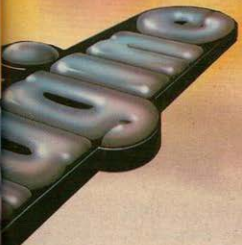

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(continued from page 135)
position. It is limited to 160 characters per operation. To delete the specified number of characters, again under cursor control, use the letter D.

The O key will overwrite up to 160 characters per operation, asking for the new text. This is also under cursor control. M will move a block of the specified number of characters, both the source and the destination being under cursor control. The P key prints out on the line printer, asking for the starting point and number of screens to print. If you want to interrupt this, you will have to press Reset, as the machine code is otherwise non-interruptible. To clear the text memory, press C.

The Z key allows the input of special characters not available from the keyboard, codes 160-222. which include some useful symbols. You can list these by typing

```
PRINT#-2,CHR$(X)
```

This is best done with a For-Next loop. This routine asks for one code, and then calls Overwrite. Pressing H will display the instructions.

The cursor is under joystick control for speed of operation. When it is correctly positioned, press R to return to the main program. Insert and Overwrite work to the right from the cursor, while Delete works to the left. After an alteration, press W to display the new version on the screen. The program is designed to use a joystick, but could be modified for keyboard control, using the arrow keys. A separate listing is shown for this purpose at the end of the main program.

Text can be stored in the form of machine-code cassette files, allowing 512 bytes per complete screen used. For example, for two screens, type

```
CCSAVEM"TEXT",5588,7023,1436
```

This will store the machine code and text, but the Basic must be stored separately.

How does it work? The Basic waits in an Inkey$ loop, and sets the relevant machine-code pointers and data addresses before transferring control to the appropriate machine-code subroutine. The machine code is very simple, consisting of routines to move blocks of character codes to the left or right as approriate. The printer commands could be easily adapted to other printers than the Seikosha GP-100A for which the program was written, but see your handbook to check whether the double-size codes are the same: 14 to enlarge, and 15 to revert to normal.

(listing continued from page 134)

```
00190 PSTART  EQU   5982
00200 SCREEN  LDX   #1024
00210         LDY   SSTART
00220         LDU   #512
00230 VLOOP   LDA   ,Y+
00240         CMPA  #32
00250         BEQ   CCH
00260         CMPA  #33
00270         BEQ   CCH
00280         CMPA  #39
00290         BEQ   CCH
00300         CMPA  #44
00310         BEQ   CCH
00320         CMPA  #46
00330         BEQ   CCH
00340         CMPA  #58
00350         BEQ   CCH
00360         CMPA  #59
00370         BEQ   CCH
00380         CMPA  #63
00390         BEQ   CCH
00400         CMPA  #97
00410         BHS   CCH2
00420 VBACK   STA   ,X+
00430         LEAU  -1,U
00440         CMPU  #0
00450         BEQ   VOUT
00460         BRA   VLOOP
00470 VOUT    RTS
00480 CCH     ADDA  #64
00490         BRA   VBACK
00500 CCH2    SUBA  #96
00510         BRA   VBACK
00520 PRINTO  LDU   PCOUNT
00530         LDX   PSTART
00540 PLOOP   LDA   ,X+
00550         CMPA  #93
00560         BEQ   PARAGR
00570         CMPA  #91
00580         BEQ   NEWLIN
00590         CMPA  #94
00600         BEQ   BIGST
00610         CMPA  #95
00620         BEQ   BIGFI
00630 PRINT   JSR   $800F
00640         LEAU  -1,U
00650         CMPU  #0
00660         BEQ   POUT
00670         BRA   PLOOP
00680 POUT    RTS
00690 BIGST   LDA   #14
00700         BRA   PRINT
00710 BIGFI   LDA   #15
00720         BRA   PRINT
00730 NEWLIN  LDA   #10
00740         BRA   PRINT
00750 PARAGR  LDA   #10
00760         JSR   $800F
00770         LDA   #32
00780         JSR   $800F
00790         LDA   #32
00800         JSR   $800F
00810         LDA   #32
00820         JSR   $800F
00830         LDA   #32
00840         JSR   $800F
00850         LDA   #32
00860         BRA   PRINT
00870 STORE   LDU   COUNT
00880         LDX   LIMIT
00890         LDD   LIMIT
00900         ADDD  COUNT
00910         STD   LIMIT
00920         LEAX  1,X
00930         LDY   TSTART
00940 SLOOP   LDA   ,Y+
00950         STA   ,X+
00960         LEAU  -1,U
00970         CMPU  #0
00980         BEQ   SOUT
00990         BRA   SLOOP
01000 SOUT    RTS
01010 INSERT  LDD   LIMIT
01020         SUBD  CADDR
01030         TFR   D,U
01040         LEAU  1,U
01050         LDX   LIMIT
01060         LDD   LIMIT
01070         ADDD  #1
01080         STD   LIMIT
01090         LDY   LIMIT
01100         LEAX  1,X
01110         LEAY  1,Y
01120 ILOOP   LDA   ,-X
01130         STA   ,-Y
01140         LEAU  -1,U
01150         CMPU  #0
01160         BEQ   INEXT
01170         BRA   ILOOP
01180 INEXT   LDD   COUNT
01190         SUBD  #1
01200         STD   COUNT
01210         LDD   #0
01220         CMPD  COUNT
01230         BEQ   IOUT
01240         BRA   INSERT
01250 IOUT    RTS
01260 DELETE  LDD   CADDR
01270         ADDD  #1
01280         STD   CADDR
01290 DELETE2 LDD   LIMIT
01300         SUBD  CADDR
01310         TFR   D,U
01320         LEAU  2,U
01330         LDD   LIMIT
01340         SUBD  #1
01350         STD   LIMIT
01360         LDX   CADDR
01370         LDD   CADDR
01380         SUBD  #1
01390         STD   CADDR
01400         LDY   CADDR
01410 DLOOP   LDA   ,X+
01420         STA   ,Y+
01430         LEAU  -1,U
01440         CMPU  #0
01450         BEQ   DNEXT
01460         BRA   DLOOP
01470 DNEXT   LDD   COUNT
01480         SUBD  #1
01490         STD   COUNT
01500         LDD   #0
01510         CMPD  COUNT
01520         BEQ   DOUT
01530         BRA   DELETE2
01540 DOUT    RTS
01550 BMOVE   LDU   COUNT
01560         LDX   SOURCE
01570         LDY   DESTIN
01580 MLOOP   LDA   ,X+
01590         STA   ,Y+
01600         LEAU  -1,U
01610         CMPU  #0
01620         BEQ   MOUT
01630         BRA   MLOOP
01640 MOUT    RTS
01650 OVERWR  LDU   COUNT
01660         LDX   CADDR
01670         LDY   TSTART
01680 OWLOOP  LDA   ,Y+
01690         STA   ,X+
01700         LEAU  -1,U
01710         CMPU  #0
01720         BEQ   OWOUT
01730         BRA   OWLOOP
01740 OWOUT   RTS
01750 CLEARM  LDX   #6000
01760         LDA   #32
01770 CLOOP   STA   ,X+
01780         CMPX  #$7FFF
01790         BHS   COUT
01800         BRA   CLOOP
01810 COUT    RTS
01820         END
```

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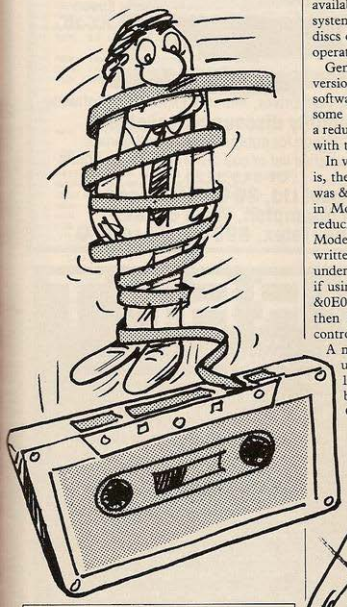
TIED IN KNOTS? TRY A DISC

BBC

John Simpson unravels the red tape and illustrates methods of transferring cassette-based programs from tape to disc.



THE BBC COMPUTER has an extensive operating system resident in a chip. The OS oversees all the low-level functions of the machine, including supporting the currently-selected filing system. In early versions of the OS not all of the present OS functions were available. You could not run a disc operating system. In upgrading your BBC to include discs one of the first things to do is get a new operating system chip — currently version 1.2.

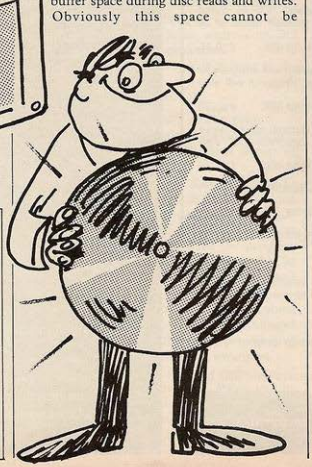
Generally the differences between the OS versions will not be noticed and existing software will function correctly. But there are some important differences and one of these is a reduction in RAM space available to the user with the new OS.

In version 0.1, the start of user RAM — that is, the address pointed to by Page in Basic — was &0E00 giving a user RAM space of 27.5K in Mode 7. The 1.2 OS sets Page to &1900, reducing user RAM by 2.75K to 24.75K in Mode 7. This means that very long programs written for the old OS may not fit into RAM under the new version. This can be overcome, if using cassette, by just setting Page back to &0E00 after power up or Break. Programs will then load in as though the old OS was in control, and run normally.

A more serious problem occurs if discs are used. The RAM between &0E00 and &1900 is used by the disc-filing system for buffer space during disc reads and writes. Obviously this space cannot be overwritten by a program being loaded if the disc system is still expected to function correctly.

Why not just load a program at the new Page address then? This is acceptable for pure Basic programs as they are fully relocatable in memory and will function anywhere in RAM. Machine code is another matter. In general, machine, code is "located" at assembly time to a particular address and must be loaded there to run correctly. The same problems occur with Basic programs that have a piece of "invisible" machine code appended on to the

(continued on page 143)



Listing 1.

```
 10 REM  GAME1
 20
 30 REM  J Simpson  28/01/83
 40
 50 REM  Loader for a mixed BASIC/
 60 REM  Machine code type program
 70 REM  for DISC System use.
 80
 90 REM  ***************************
100 MODE7
110 REM  Relocate this program to high
120 REM  memory and restart it.
130
140 IF PAGE=&1900 THEN PAGE=&6000:
    CHAIN"GAME1"
150
160 REM  ***************************
170
180 REM  This is where the game's
190 REM  initialisation code goes.
200
210 REM  ***************************
220
230 REM  Load the game machine code...
240
250 *LOAD"Game1obj" 1900
260
270 REM  ...and move it to &E00 as in
280 REM  a TAPE filing system.
290
300 PROCMOVE
310
320 REM  The next line starts the game
330 REM  machine code.
340 REM  The actual Hex number in
350 REM  Line 390 is the EXECUTION
360 REM  address given by the TAPE
370 REM  filing system.
380
390 CALL &8000
400
410 REM  ***************************
420
430 REM  This procedure assembles
440 REM  machine code to move the game
450 REM  code down to where it would
460 REM  be in a TAPE filing system.
470
480 DEFPROCMOVE
485 REM  I.Birnbaum's mover routine
490 SIZE=&70:SOURCE=&72:DEST=&74
500 DIM STARTMOVE 40
510 FOR I%=0 TO 2 STEP 2:P%=STARTMOVE
520  [OPT I%
530  LDY #0
540  LDX SIZE+1
550  BEQ LOOP1
560  .LOOP
570  LDA (SOURCE),Y
580  STA (DEST),Y
590  INY
600  BNE LOOP
610  INC SOURCE+1
620  INC DEST+1
630  DEX
640  BNE LOOP
650  .LOOP1
660  LDX SIZE
670  BEQ DONE
680  .LOOP1
690  LDA (SOURCE),Y
700  STA (DEST),Y
710  INY
720  DEX
730  BNE LOOP1
740  .DONE
750  RTS
760  ]:NEXT
770
780
790 REM  The Size value in Line 830 is
800 REM  also obtained from the TAPE
810 REM  filing system.
830 !SIZE=&3000:!SOURCE=&1900:
    !DEST=&0E00
840 CALL STARTMOVE
850 ENDPROC
```

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(continued from page 141)

end. Here the Basic program must be loaded at the correct address to ensure that the machine code is also properly located.

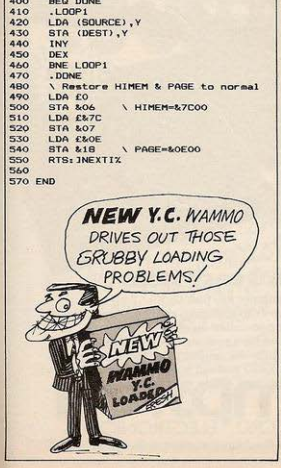
Several solutions have already appeared in magazines; for the most part proving slow, or cumbersome, or have only worked with pure Basic programs. I have developed solutions which allow fast loading of Basic, machine code or combinations of these, without using a function key.

Listing 2.

```
10 REM GAME2
20 REM Loader for a 'Long'
30 REM machine code program
40 REM J Simpson 28/01/83
50
60 IF PAGE=&1900THEN PAGE=&900:
   HIMEM=&B00:CHAIN"GAME2"
70 CLS:VDU 28,1,22,38,18
80 PRINTCHR$141"ADVENTURE":PRINTCHR$141
   "ADVENTURE" "CHR$13A"LOADING..."
 90 *LOAD"Game2obj" 1100
100 !&70=&6DFF:!&72=&1100:!&74=&0E00
110 *RUN"$.MOVR"
120 VDU26,12
130 CALL&8000
```

Listing 3.

```
 10 REM  MOVER
 20
 30 REM  This program assembles a
 40 REM  machine code "mover" which
 50 REM  allows TAPE based programs
 60 REM  to run on a DISK system
 70
 80 REM  The mover program executes
 90 REM  from the User Defined
100 REM  Character buffer space.
110
120 REM  J Simpson  28/01/83
130
140
150 REM  **************
160
170 REM  Variables:
180
190 SIZE=&70:REM NUMBER OF BYTES TO MOVE
200 SOURCE=&72:REM SOURCE POINTER
210 DEST=&74:REM DESTINATION POINTER
220 REM  I.Birnbaum's mover routine
230 REM  **************
240 FOR I%=0 TO 3 STEP 3:P%=&C00
250   [OPT I%
260   LDY £0
270   LDX SIZE+1
280   BEQ LOOP1
290   .LOOP
300   LDA (SOURCE),Y
310   STA (DEST),Y
320   INY
330   BNE LOOP
340   INC SOURCE+1
350   INC DEST+1
360   DEX
370   BNE LOOP
380   .LOOP1
390   LDX SIZE
400   BEQ DONE
410   .LOOP1
420   LDA (SOURCE),Y
430   STA (DEST),Y
440   INY
450   DEX
460   BNE LOOP1
470   .DONE
480   \ Restore HIMEM & PAGE to normal
490   LDA £0
500   STA &06     \ HIMEM=&7C00
510   LDA &B7C
520   STA &07
530   LDA &B0E
540   STA &18     \ PAGE=&0E00
550   RTS:]NEXTI%
560
570 END
```



There are fundamentally three types of program that require the use of a loader to operate with the disc system. I will consider each separately. I have used for examples the program structure found in some commonly available popular programs for the model B. The loaders presented can be used for other, similar programs.

Firstly the required program must be loaded from cassette on to disc. Some additional information to that normally given by the tape-filing system must be obtained about the program being loaded. Luckily, this can be obtained by following the information given on page 398 of the User Guide. Here, almost hidden from sight is how to find the Length, Load and Execution Addresses for any tape file.

By typing

*OPT 1,2

the tape-filing system will give the required information as the tape is loaded. It is best to use

*LOAD "" 1900

to load the program — Basic or machine code — from tape. You then know where the data is and can be sure that the disc-filing system will not overwrite anything. After loading, the screen will display a row of hexadecimal numbers in the following format:

filename BB LLLL SSSSSSSS FFFFFFFF EEEEEEEE

The meaning of these numbers is:

BB	Number of blocks — a block is 256 bytes long
LLLL	length in bytes
SSSSSSSS	Start address of data — if *Loaded with no over-ride address
FFFFFFFF	Finish address of data
EEEEEEEE	Execution address — this will usually be FFFF801F for a Basic program

Note that only the right-hand four hexadecimal characters need to be used in during a subsequent *Save to disc; all eight characters represent a 32-bit address needed for future BBC system expansion.

To store the data on disc switch back to the DFS by typing

*DISC

followed by

*SAVE filename 1900 +LLLL EEEE

using the numbers obtained during loading. See page 392 of the User Guide if unsure of this procedure.

If the program is so long that it will not fit into memory from &1900 it is possible to load it at &1100 instead. However make sure that you do not use any DFS function other than *Save or *Load until you have the program safely written to disc. Even the use of *Cat will overwrite some bytes between &1100 and &1900.

We can now turn to the techniques involved in running the program from disc. Programs generally fall into one of three types, each of which is given in the following examples.

The short Basic plus machine-code type of program has a short piece of Basic to, for example, set up Envelopes for the Sound function, or to define user graphics characters. The main machine code is then *Loaded and a Call is made to the machine code's Execution address. Many arcade-type games use this technique. To use this type of program with discs some modifications are made to the short Basic program as shown in listing 1.

There are six main points to note from this listing. First, line 140 relocates this program up into high memory, well clear of the machine code to be *Loaded from disc. Second, lines 160 to 210 are where the original arcade game initialisation code was. You will have to replace these statements from your own tape version of the program. Third, line 250 *Loads the machine code starting at &1900 which is clear of the disc I/O buffer space. Point four is that line 300 calls a procedure to move the game machine code to the place it would normally occupy in a tape-based system. Note that after this point the disc system cannot be used again without corrupting the relocated machine code. Next, line 830 sets up the number of bytes to move and the source/destination addresses. This "number of bytes" data is obtained when the original program is loaded from tape as explained earlier. Finally line 390 starts the main machine-code program. This line was in the original Basic loader program but it could also be obtained from the Execution address field from the tape-filing system.

For my next example, long machine-code programs are typified in several Adventure games. The program is a very long machine-code program — over 6DFF bytes — and almost fills up all available memory in Mode 7, using the tape-filing system. It would thus appear impossible to load and run this type of program from disc. However a small quirk in the disc-filing system allows everything to fit into memory. Refer to listing 2 to see how this loader works.

The key to the solution is that, if using discs just for *Loading programs, memory upwards from &1100 can be used for user programs, rather than &1900 as is the case when other disc functions are performed. The other important point can be seen in line 60 of listing 2.

Here a similar trick to that used in listing 1 is used to relocate the loader program into a safe area of memory. In this case, however, the Basic program of listing 2 is moved into the unused RS-423 buffer space. Himem is set to the end of this space which prevents Basic's stack destroying any of our large machine-code program, before it is moved to the correct place in memory. You should also note that line 70 clears screen memory and sets up a text window near the bottom of the screen. This is required because the machine-code program being read from disc is so large that it temporarily lies within the screen memory area; you will see it flash on to the screen for a couple of seconds before it is moved down in memory.

Line 100 sets up parameters for the actual mover program which is called by line 110. Because of space limitations, the routine which was Procmove in listing 1 has been separately assembled and is saved on disc as a program called Movr. The assembly is accomplished by listing 3 which produces a small machine-code mover located at address &0C00 — the user-defined character buffer.

(continued on next page)

(continued from previous page)

Page zero memory locations &70-&75 are used as before for storing the size, source, and destination variables as used by listing 1. Movr should be *Saved on the same disc as the main program to be laoded. This is accomplished by typing

*SAVE MOVR 0D00 +30

after running listing 3.

Once the target machine-code program has been moved to the correct place in memory it is run by line 130. As before this address can be obtained by using the Tape-filing system Execution Address data.

The last type of program, the long Basic program is seen in several Adventure games. The method required here is similar to the previous case, with a few changes to ensure that the Basic interpreter has its pointers set up correctly, before the final relocated program is executed.

The program in listing 4 is used to load and relocate the Basic code. Lines 10 to 100 perform identical functions to those in listing 2. In lines 120 to 190 repeated use of

*FX138

is used to load

O L D <C R> R U N <C R>

into the keyboard buffer. Then the machine code mover program is run to shift the long Basic program down in memory. When a return is made from the mover the keyboard contents are sent to the Operating System as though directly typed in. Old resets Basic's pointers which will now refer to the large program located at &0E00. Run then executes that program.

The techniques used in listings 1 to 4 can be adapted to run virtually any program on a disc-based BBC computer.

Bear in mind that when the program has been moved down in memory the disc system will no longer be able to operate as its I/O buffer space is overwritten. Any use of disc functions will overwrite some of the program and will require that a Break be done to restart the computer. ■

Listing 4.

```
 10 REM GAME3
 20 REM Loader for a 'Long' BASIC
 30 REM program for DISC
 40 REM D Simpson 28/01/83
 50
 60 IF PAGE=&1900THEN PAGE=&900:
    HIMEM=&B00:CHAIN"GAME3"
 70 CLS:VDU 28,1,22,38,15
 80 PRINTCHR$141"ADVENTURE":PRINTCHR$141
    "ADVENTURE":PRINT'CHR$136"LOADING..."
 90 *LOAD"Game3obj" 1900
100 !&70=&6400:!&72=&1900:!&74=&0E00
110 REM PUT "OLD RUN" in key buffer
120 *FX138,0,79
130 *FX138,0,76
140 *FX138,0,68
150 *FX138,0,13
160 *FX138,0,82
170 *FX138,0,85
180 *FX138,0,78
190 *FX138,0,13
200 *RUN"$.MOVR"
```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The program lines are typed in as usual. Since graphics characters are not easily read from a listing, the title graphics are illustrated as they appear. These should be entered using the entry program — lines 9100 to 9203. The picture will gradually build up on the screen. Mistakes can be quickly spotted and easily rectified. This useful program can also be used to enter the text for the string array C$. Remember that whatever you enter via the entry program is contained in B$ and must be re-allocated by direct command, to

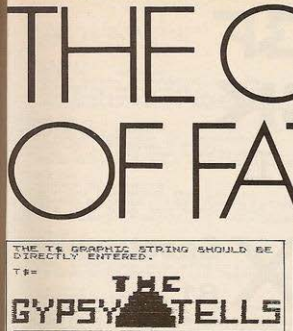
```
T$(LET T$ = B$)
```

in the case of the graphics, or for text to

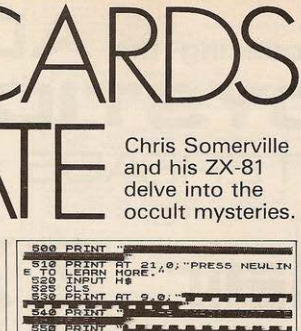
```
C$(x)
```

Now find your destiny in the Cards of Fate.

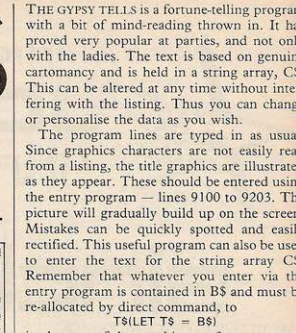
```
THE T$ GRAPHIC STRING SHOULD BE
DIRECTLY ENTERED.
T$=
```




```
  5 S.OU
 10 PRINT T$
 11 PRINT "
 12 PRINT "                    OF
                              ARCANA
                              LORE
 15 PRINT AT 21,0;"          PRESS N
EWLINE TO BEGIN"
 20 INPUT H$
 45 CLS
 50 PRINT "                IN  CARTOMANCY-THE TE
CHNICAL NAME FOR DIVINATION BY PL
AYING CARDS-WE USE THE ACES,PICT
URE CARDS  AND ALL SPOT CARDS U
PLIED AT      SEVEN OR OVER.
                 IF YOU WISH TO CONSU
LT THE CARDS PLEASE MENTALLY CHOO
SE A CARD.
 51 PRINT "IT MAY BE ANY CARD
OF ANY SUIT,BUT IT MUST BE A SEV
EN OR HIGHER.
                 PRESS NEWLINE WHEN Y
OU HAVE          DECIDED UPON YOUR CA
RD
 52 INPUT H$
 55 CLS
 55 PRINT AT 5,0;"
                 NOW WE MUS
T FIX THAT CARD          FIRMLY I
N YOUR MIND
                 SEARCH FOR
YOUR CARD IN THE          FOLLO
WING LISTS
 60 PAUSE 250
 70 CLS
100 LET POT=0
101 LET TOT=1
105 FOR J=1 TO 5
120 PRINT "          CAN YOU SEE YOU
R CARD?"
121 PRINT "
140 PRINT L$(J)
145 PRINT "
150 PRINT AT 20,0;"CAN YOU SEE
YOUR CARD? ENTER  ""YES"" OR "
"NO"";THEN PRESS NEWLINE"
170 INPUT H$
171 IF H$="" THEN GOTO 53
175 CLS
195 IF J>1 THEN LET TOT=TOT*2
197 IF CODE H$=62 THEN LET POT=
POT+TOT
210 NEXT J
220 IF POT<1 THEN GOSUB 7000
230 PRINT AT 6,0;"
235 PRINT "YOU SHOULD HAVE YOUR
CHOSEN CARD FIRMLY IN MIND NOW."
240 PRINT "
245 PRINT "THE CARD YOU ARE THI
NKING OF IS KNOWN AS THE
250 PRINT "
250 PAUSE 250
260 CLS
270 PRINT "YOU ARE THINKING OF
THE...."
280 PAUSE 80
290 PRINT AT 9,0;C$(POT,1 TO 32
)
400 PRINT "
410 PRINT "THIS IS THE SIGNIFIC
ATOR."
420 PRINT AT 21,0;"PRESS NEWLIN
E TO LEARN MORE."
430 INPUT H$
450 CLS
460 PRINT "  THE SIGNIFICATOR IND
ICATES THAT
470 PRINT C$(POT,33 TO 96)
480 PRINT "WILL PROVE OF IMPORT
ANCE TO YOU ESPECIALLY IN "
490 PRINT C$(POT,97 TO 160)
```



```
500 PRINT "
510 PRINT AT 21,0;"PRESS NEWLIN
E TO LEARN MORE."
520 INPUT H$
525 CLS
530 PRINT AT 9,0;"
540 PRINT "
556 PRINT "
559 DIM A(32)
560 DIM A(32)
570 FOR I=1 TO 32
580 LET A(I)=I
590 NEXT I
595 CLS
597 FOR J=1 TO 2
600 FOR I=1 TO 32
610 LET R=INT ((RND*32)+1)
620 LET X=A(I)
630 LET A(I)=A(R)
640 LET A(R)=X
650 LET U=A(I)
652 PRINT "                ";C$(U, TO 17
),"  "
654 IF I=21 OR I=32 THEN CLS
670 NEXT I
680 NEXT J
700 PRINT AT 6,0;"
710 PRINT "
720 PRINT "
730 PRINT "
740 PRINT "
750 LET A=A(1)
760 LET B=A(2)
770 LET C=A(3)
780 LET D=A(4)
790 INPUT H$
800 CLS
1000 PRINT "          THESE ARE YOUR
CARDS.  PRESS NEWLINE TO
SEE EACH ONE."
1010 PRINT "
1025 PRINT "
1030 PRINT "
1040 INPUT H$
1050 PRINT AT 3,4;"                ";C$(A,
TO 17)
1060 PRINT AT 5,4;"
1070 INPUT H$
1080 PRINT AT 7,4;"  ";C$(B,
TO 17)
1090 PRINT AT 9,4;"  "
1100 INPUT H$
1120 PRINT AT 11,4;"  ";C$(C,
TO 17)
1140 PRINT AT 13,4;"
1145 INPUT H$
1150 PRINT AT 15,4;"  ";C$(D,
TO 17)
1170 PRINT AT 17,4;"  "
1175 PAUSE 100
1180 PRINT AT 19,6;"NOW PRESS NE
WLINE TO"
1190 PRINT AT 20,8;"TO READ THE
CARDS"
1200 INPUT H$
1205 CLS
1210 PRINT "
1215 PRINT "
1220 PRINT C$(A, TO 17)
1230 PRINT "
1240 PRINT C$(A,33 TO 96)
1250 PRINT "
1260 PRINT C$(A,97 TO )
```



```
1270 PRINT "
1280 PRINT AT 21,0;"PRESS NEWLIN
E TO LEARN MORE"
1290 INPUT H$
1300 CLS
1310 PRINT "
PRESENT
1320 PRINT C$(B, TO 17)
1330 PRINT "
1340 PRINT C$(B,33 TO 96)
1350 PRINT "
1360 PRINT C$(B,97 TO )
1370 PRINT "
1380 PRINT AT 21,0;"PRESS NEWLIN
E TO LEARN MORE."
1390 INPUT H$
1400 CLS
1500 PRINT "
1510 PRINT C$(C, TO 17)
1520 PRINT C$(D, TO 17)
1530 PRINT "
1540 PRINT C$(C,33 TO 96)
1550 PRINT "
1560 PRINT C$(D,33 TO 96)
1570 PRINT "
1580 PRINT C$(C,97 TO )
1590 PRINT "
1600 PRINT C$(D,97 TO )
1610 PRINT "
1620 PRINT AT 21,0;"PRESS NEWLIN
E WHEN READY."
1630 INPUT H$
1640 CLS
1650 PRINT AT 5,0;"
THE TARGETS
1660 PRINT "
THEN PRESS NEWLINE
."
1670 INPUT H$
1675 IF H$="" THEN GOTO 1640
1680 CLS
1690 IF VAL H$=1 THEN GOTO 1205
1700 IF VAL H$=2 THEN GOTO 1
1710 IF VAL H$=3 THEN PRINT AT 1
2,11;"GOOD BYE"
1720 PRINT AT 19,0;"THIS PROGRAM
HE IS FOR AMUSEMENT  ONLY.UE HO
PE YOU HAVE BEEN
AMUSED."
5999 STOP
7000 PRINT AT 6,0;"
WAS YOUR CARD
AN ODD NUMBER
ED CARD?
"
7010 PRINT "PLEASE ENTER YES OR
NO, AND THENPRESS NEWLINE."
7020 INPUT H$
7025 IF H$="" THEN GOTO 7000
7030 IF CODE H$=62 THEN LET POT=
92
7040 IF CODE H$=61 THEN LET POT=
91
7045 CLS
7050 RETURN
7999 STOP
8000 CLS
8010 SAVE "@"
8020 GOTO 5
```

(continued on page 149)

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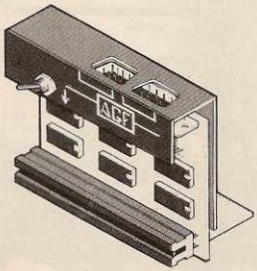

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(continued from page 147)

```
FIRST DIM C$(32,160)
THEN ENTER TEXT BY
DIRECT COMMAND

C$(1)=
ACE OF   HEARTS.
GOOD NEWS. ROMANTIC AND/OR
DOMESTIC HAPPINESS.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(2)=
KING OF  HEARTS.
A HANDSOME MAN OF GENEROUS
NATURE. PROBABLY FAIR.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(3)=
QUEEN OF HEARTS.
A KIND GENEROUS AND LOVING
WOMAN.PROBABLY FAIR COMPLEXION.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(4)=
JACK OF  HEARTS.
FRIEND OR LOVER. PERHAPS NOT
ENTIRELY TO BE TRUSTED?
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(5)=
TEN OF  HEARTS.
SUCCESS. HAPPINESS. UNEXPECTED
GOOD FORTUNE.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(6)=
NINE OF  HEARTS.
A HAPPY OUTCOME. HOPES COME TO
FRUITION.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(7)=
EIGHT OF HEARTS.
DOMESTIC CONTENT. AN INVITATION.
A JOURNEY. A VISIT.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(8)=
SEVEN OF HEARTS.
A FEELING OF CONTENTMENT.
CONTENTMENT IN MARRIAGE.
THE EMOTIONS AND AFFECTIONS.
FRIENDSHIP,FAMILY AND MARRIAGE

C$(9)=
ACE OF   SPADES.
A LOVE OR BUSINESS PROPOSITION.
LEGAL MATTERS.
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(10)=
KING OF  SPADES.
A MAN OF THE LAW. HIS ADVICE
MAY NOT BE TO YOUR ADVANTAGE.
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(11)=
QUEEN OF SPADES.
A CRAFTY LADY. SUBTLE. A WIDOW
OR DIVORCEE PERHAPS?
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(12)=
JACK OF  SPADES.
A DARK YOUNG MAN. DEVIOUS.
COULD BE CAPABLE OF TREACHERY.
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(13)=
TEN OF   SPADES.
A LETTER CAUSES WORRY. A
JOURNEY. CONFINEMENT OF SORTS?
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(14)=
NINE OF  SPADES.
FAILURE
MISFORTUNE.
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(15)=
EIGHT OF SPADES.
BAD NEWS.
SORROW.
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(16)=
SEVEN OF SPADES.
QUARRELS AND FRICTION.
UNWANTED ADVICE OR CRITICISM.
MISFORTUNE.WARNINGS.ENEMIES.
SCANDAL.SUFFERING.BETRAYAL.LOSS.

C$(17)=
ACE OF   DIAMONDS.
IMPORTANT DOCUMENT/LETTER.
JEWELLERY-COULD BE A RING?
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(18)=
KING OF  DIAMONDS.
A MAN OF AUTHORITY. POWERFUL
AND STRONG.
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(19)=
QUEEN OF DIAMONDS.
A SPITEFUL WOMAN. POSSIBLY
GOOD-LOOKING. BUT UNDERNEATH?
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(20)=
JACK OF  DIAMONDS.
A UNIFORMED MAN.
A MESSENGER OR MESSAGE.
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(21)=
TEN OF   DIAMONDS.
A CHANGE OF SOME KIND WHICH
COULD INVOLVE A JOURNEY.
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(22)=
NINE OF  DIAMONDS.
NEWS. CONCERNING MONEY OR THE
LATEST ENTERPRISE?
WORLDLY  AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(23)=
EIGHT OF DIAMONDS.
SHORT JOURNEYS. USUALLY
PLEASANT.
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(24)=
SEVEN OF DIAMONDS.
SURPRISING ,HURTFUL CRITICISM.
AN  UNEXPECTED GIFT.
WORLDLY AFFAIRS. GENERAL
MATTERS-NO PERSONAL CONTROL.

C$(25)=
ACE OF   CLUBS.
FINANCIAL  SUCCESS.
SUCCESS IN OTHER FIELDS.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(26)=
KING OF  CLUBS
A HELPFUL,FRIENDLY MAN.
PROBABLY DARK. AN OLDER MAN.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(27)=
QUEEN OF CLUBS.
AN AFFECTIONATE,HELPFUL WOMAN.
POSSIBLY A WIDOW.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(28)=
JACK OF  CLUBS.
A YOUNG MAN. POSSIBLY DARK.
SINCERE IN MATTERS OF AFFECTION.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(29)=
TEN OF   CLUBS
UNEXPECTED MONEY. A PRIZE?
LEGACY? A RISE?
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(30)=
NINE OF  CLUBS.
A GOOD MARRIAGE.
FINANCIAL ADVANTAGE.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(31)=
EIGHT OF CLUBS.
JOY,GOOD FORTUNE. OFTEN BROUGHT
BY YOUNG GIRL OR WOMAN. DARK.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

C$(32)=
SEVEN OF CLUBS.
A SMALL CHILD. PERHAPS SOME
ASSOCIATION WITH MONEY. A GIFT.
FRIENDSHIP,LOYALTY,MONEY. WORRY,
ANXIETY,BETRAYAL.

9100 REM TEXT OR GRAPHIC ENTRY
       ROUTINE.INCOMPLETE
       LINES MAY BE ENTERED
       AND WILL BE MADE UP
       TO COMPLETE LINES WITH
       SPACES.FINAL GRAPHIC
       OR TEXT HELD AS B$.
9101 REM WHEN ENTERING TEXT USE
       "ENTER" AS THE RETURN KEY
       ON A TYPEWRITER.
9102 REM ENTER "ERROR" TO DELETE
       INCORRECT LINES
       ENTER "STOP" WHEN GRAPHICS
         ARE COMPLETE /
9103 CLS
9104 LET B$=""
9105 INPUT A$
9106 IF A$="STOP" THEN GO TO 912
0
9107 IF A$="ERROR" THEN GO TO 91
13
9108 PRINT A$
9109 IF LEN A$/32<>INT (LEN A$/3
2) THEN LET A$=A$+" "
9110 IF LEN A$/32<>INT (LEN A$/3
2) THEN GO TO 9109
9111 LET B$=B$+A$
9112 GO TO 9105
9113 PRINT AT 21,0;"ERASE HOW MA
NY LINES?"
9114 INPUT X
9115
9116 CLS
9117 LET B$=B$( TO LEN B$-32*X)
9118 PRINT B$
9119 GO TO 9105
9120 CLS
9121 PRINT AT 10,0;"YOUR COMPLET
E TEXT OR GRAPHIC   CAN BE RECAL
LED BY PRINT B$"
9023 STOP
```

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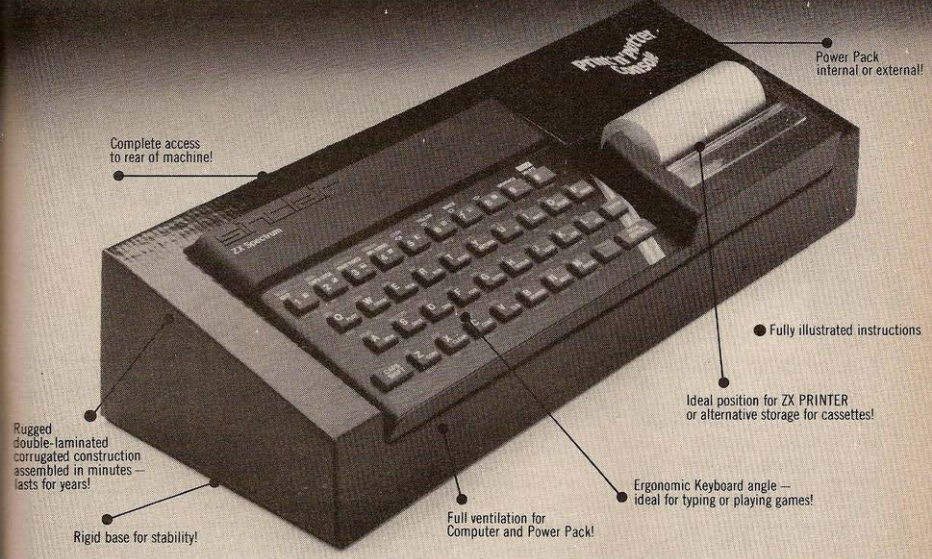

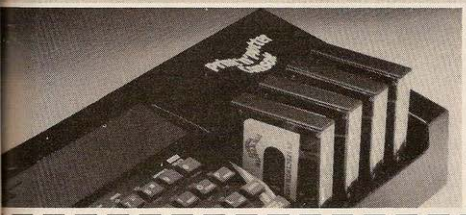

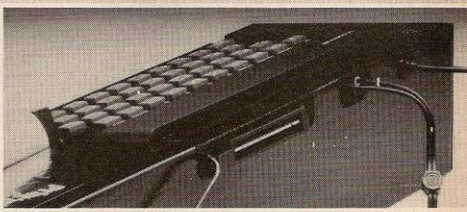

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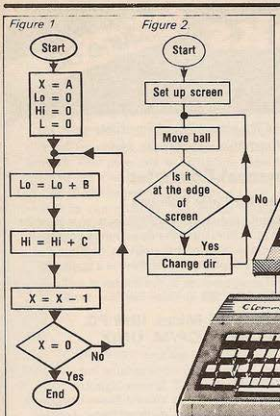
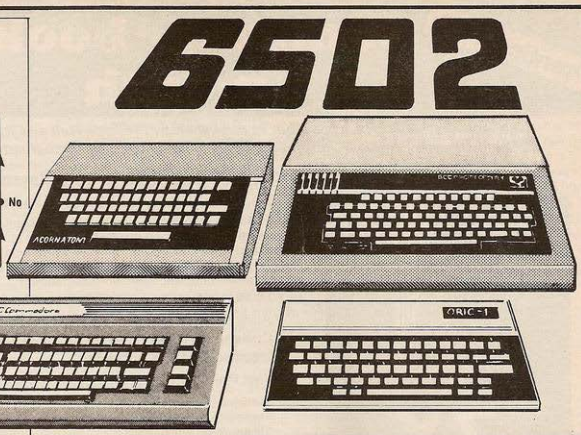
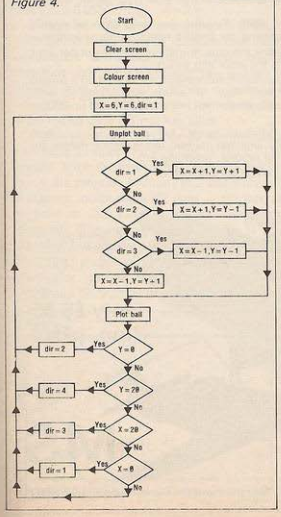




6502 MACHINE CODE

Darryl Mattocks looks at the compare functions in his series on 6502 code.

Figure 4.



USING VARIOUS BRANCH commands we can find the Basic equivalent of:

BEQ — IF A=0 OR A=256 THEN . . .
BNE — IF A<>0 AND A<256 THEN . . .
BPL — IF A<128 THEN . . .
BMI — IF A>=128 THEN . . .

But what if we need numbers other than 128 — such as the machine-code equivalent of:

IF A<=13 THEN . . .

or

IF A=57 THEN . . .

Obviously using the techniques described so far this is not possible. Consider then the effect of a subroutine in this Basic program.

```
10 INPUT A
20 INPUT B
30 C=1:Z=0
40 D=A-B
41 IF D<0 THEN C=0
42 IF D=0 THEN Z=1
50 IF Z=1 THEN PRINT "A=B":RUN
60 IF C=0 THEN PRINT "A<B":RUN
70 IF C=1 THEN PRINT "A=>B":RUN
80 IF Z=0 THEN PRINT "A<>B":RUN
```

Notice how by first subtracting the A, operations are all now possible using the carry and zero flag jumps — BCS, BEQ, BNE and BCC — already available.

This is what the CMP function does . . . it takes the operand away from the accumulator and sets the N, negative, Z, zero, and C, carry, bits depending on the result which it then discards. The operand and the contents of the accumulator remain unchanged. After a CMP command the following branches can be used:

Branch	detects	Basic equivalent
CMP -> BEQ	A=DATA	IF A=D THEN
CMP -> BNE	A<>DATA	IF A<>D THEN
CMP -> BCS	A>=DATA	IF A>=D THEN
CMP -> BCC	A<DATA	IF A<D THEN
CMP -> BNE -> BCS	A>DATA	IFA>D THEN

In some cases we do not wish to use the accumulator so we have CPX and CPY commands as well. These operate in exactly the same way as the CMP command except that the data is compared with the X and Y registers respectively.

To deal with machine-code For-Next loops we use the immediate mode of addressing to check whether the contents of an ever-increasing register are equal to a set value, such as using the X register and comparing with 15.

Op-code	Mnemonic	Basic
A2 04	LDX #4	10 X=4
8E 05 90	STX 36879	20 POKE 36879,X
E8	INX	30 X=X+1
E0 0F	CPX #15	40 C=1:Z=0:D=X-15
		43 IF D=0 THEN Z=1
		46 IF D<0 THEN C=0
D0 F8	BNE	50 IF Z=0 THEN 20
		55 REM***IF X<15 THEN 20
60	RTS	60 RETURN

All of these could be replaced less literally with

(continued on page 155)

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(continued from page 153)

```
10 FORX=4T015
20 POKE36879,X
30 NEXT
40 END
```

but whereas the Basic version is two lines shorter the machine code is approximately 200 times faster.

We have seen the delay subroutine which counted from 1 to 65,000 in just under two seconds. Compare this to the Basic time and you can get the idea of just how impressive that is. With the processor counting from 1 to 65,000 in two seconds, this means that it is going around the following loop 32,000 times every second.

```
LDX  #255
LDY  #255
DEY  This is carried out at an average once
BNE  every 1/30,000 seconds
DEX
BNE
RTS
```

This is fine when writing to slow down a program, but what of a text editor which needs to scan through several K of text as fast as possible.

In Basic, the speed of each command is not listed but in this program changing line 30 can give us the times for several functions so that we can compare them.

```
10 TI$="000000"
20 FOR I=0 TO 100 STEP 0.01
30 REM Function goes here
40 NEXT
50 PRINT TI$
```

Total time	Average time	Function
40	0.0040	IF I=-5 THEN END
39	0.0039	A=I+2
60	0.0060	A=I/2
290	0.0290	A=SIN(I)
480	0.0480	PRINT I
490	0.0490	A=INVERSE COSH(I)
530	0.0530	A=2↑I

Notice how the speeds vary from 0.0040s. to 0.0530s. It is the same in machine code, some commands are faster than others, but in machine code we can quantify this and say by exactly how much one function is faster than the other. This is because we know how many time cycles each instruction takes.

Every processor executes its commands in the same manner. First it has to fetch. This means: fetch the instruction currently pointed to by the program counter, PC, and store it in a register inside the 6502 chip — the internal register or IR. Then it has to Decode and Execute. The instruction in the IR is now decoded and acted upon. The total time taken for this stage varies depending on the particular instructions, for instance the command NOP, No Operation does not access the RAM or ROM, but LDA ($IE00) Y does and thus takes longer.

This time is expressed in cycles where 1 cycle is the reciprocal value of the frequency of clock used in the processor.

In the Vic-20 then, assuring the fetch phase is very fast, each cycle is 1/32000 or 904 ns. long, 1 second = 1,000,000,000 nano seconds, the frequency of the internal clock in the Vic-20 is 1.1058 MHz. The LDA #45, for example, take two cycles and thus 1,808 ns. The LDA #45 instruction can be performed approximately 500,000 times per second. It is no wonder then that the decrement and branch sequence of the timing loop can be executed 65,000 times within two seconds.

Having spent hours one week trying to get a particular multiplication program to work and failing dismally, multiplication is my pet hate, so whenever possible I try and avoid it. Every so often, however, there is no escape. This is usually when using X and Y co-ordinates for screen positions and then using the machine code version of:

Address = X + Y * 22 (40 for CBM 64, Pet, etc)

There is a way around the multiplication problem though. When working out 7*5 we are actually evaluating 5+5+5+5+5+5+5 so if we can add in machine code, why not add A to itself B times to achieve A*B.

Let us now try to get the result of multiplying A by B in a simple machine-code program of the form of adding B to itself A times. See figure 1, where C is the carry bit, X is the X register and Lo and Hi are low and high addresses in zero page, such as 00 and 01.

This works but there are two points to watch. As we are using X as a one byte counter, either A or B must be less than 255. The two-byte addition of low and high equals low and high plus seven takes place A times. When A is small — less than 40 — the routine can operate in a few cycles, approximately 0.005 seconds, but as A gets larger, the time needed starts to get significant and a proper multiplication program — we shall cover this next month — should be used.

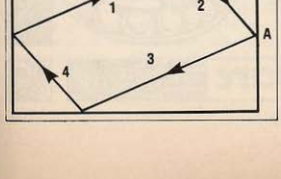
Program 1 multiplies A and B, where A is stored in location 0, B in location 1 and the result ends up in locations 2 (Lo) and 3 (Hi).

Program 1.

Address	Op-code	Mnemonics	Basic
1A2C	A6 00	LDX $00	10 X = A

(continued on page 157)

Figure 3.

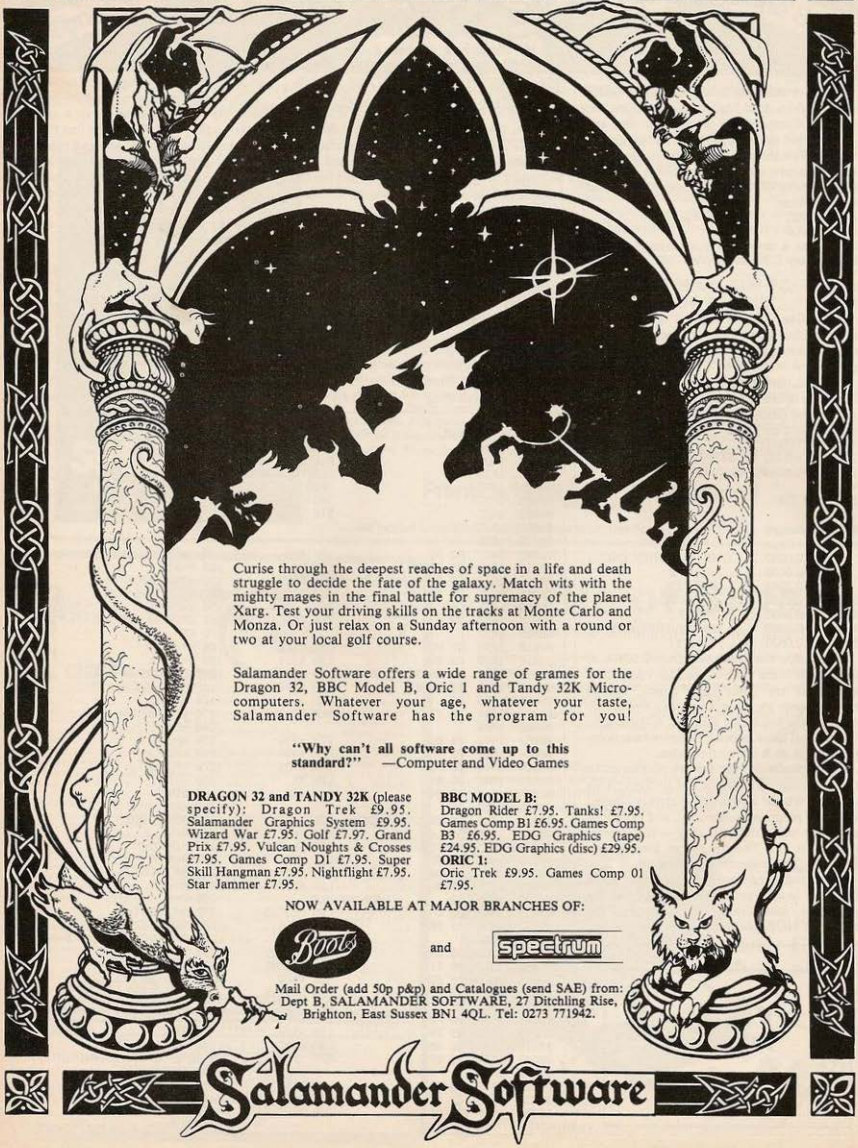


Program 2.

```
LINE# LOC   CODE        LINE
00001 0000                    #=6700
00002 1A2C                    PLOTLO = $0000
00003 1A2C                    PLOTHI = $0001
00004 1A2C                    XPOS   = $0002
00005 1A2C                    YPOS   = $0003
00006 1A2C                    DIR    = $0004
00007 1A2C              ;
00008 1A2C              ;
00009 1A2C  A2 00             LDX #00          ;10 X=256
00010 1A2E  A9 20             LDA #$20         ;20 A=32
00011 1A30  9D 00 1E    BRNCH1 STA $1E00,X     ;30 POKE 7680+X,A
00012 1A33  9D 00 1F          STA $1F00,X      ;40 POKE 7936+X,A
00013 1A36  CA                DEX              ;50 X=X-1
00014 1A37  D0 F7             BNE BRNCH1       ;60 IF X<>0 THEN 30
00015 1A39                                     ;70 REM
00016 1A39  A2 00             LDX #$00         ;80 X=256
00017 1A3B  A9 00             LDA #$00         ;90 A=1
00018 1A3D  9D 00 96    BRNCH2 STA $9600,X     ;100 POKE 38400+X,A
00019 1A40  9D 00 97          STA $9700,X      ;110 POKE 38656+X,A
00020 1A43  CA                DEX              ;120 X=X-1
00021 1A44  D0 F7             BNE BRNCH2       ;130 IFX<>0THEN 100
00022 1A46                                     ;140 REM
00023 1A46  86 03             STX YPOS         ;150 YPOS=X
00024 1A48  A2 0F             LDX #$0F         ;160 X=15
00025 1A4A  86 02             STX XPOS         ;170 YPOS=X
00026 1A4C  A2 01             LDX #1           ;180 X=1
00027 1A4E  86 04             STX DIR          ;190 DIR=X
00028 1A50                                     ;200 REM
00029 1A50  20 E6 1A    LOOP  JSR DELAY        ;205 GOSUB 950
00030 1A53  A9 1E             LDA #$1E         ;210 A=30
00031 1A55  85 01             STA PLOTHI       ;220 HIPLOT=A
00032 1A57  A5 02             LDA XPOS         ;230 A=XPOS
00033 1A59  85 00             STA PLOTLO       ;240 A=LOPLOT
00034 1A5B  A6 03             LDX YPOS         ;250 X=YPOS
00035 1A5D  18          BRNCH3 CLC             ;260 C=0
00036 1A5E  A5 00             LDA PLOTLO       ;270 A=LOPLOT
00037 1A60  69 16             ADC #$16         ;280 A=A+C+22
00038 1A62                                     ;285 IF A=>256THENC=1:A=A-256
00039 1A62  85 00             STA PLOTLO       ;290 LOPLOT=A
00040 1A64  A5 01             LDA PLOTHI       ;300 A=HIPLOT
00041 1A66  69 00             ADC #$00         ;310 A=A+C+0
00042 1A68  85 01             STA PLOTHI       ;320 HIPLOT=A
00043 1A6A  CA                DEX              ;330 X=X-1
00044 1A6B  D0 F8             BNE BRNCH3       ;340 IFX<>0THEN260
00045 1A6D  A9 20             LDA #$20         ;350 A=32
00046 1A6F  A0 00             LDY #$00         ;360 Y=0
00047 1A71  91 00             STA (PLOTLO),Y;370 POKE(LOPLOT+256*HIPLOT+Y),A
00048 1A73                                     ;380 REM
00049 1A73  A5 04             LDA DIR          ;390 A=DIR
00050 1A75  C9 01             CMP #1           ;400 Z=0:IFA=1THENZ=1
00051 1A77  D0 07             BNE BRNCH4       ;410 IFZ=0THEN450
```

(listing contined on page 157)

WINDOW ON ANOTHER WORLD



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(continued from page 155)

```
1A2E    A9 00    LDA #0      20 AC = 0
1A30    85 02    STA $02     30 POKE 2, AC
1A32    85 03    STA $03     40 POKE 3, AC
1A34    18       CLC         50 C = 0
1A35    A5 02    LDA $02     60 AC = PEEK
                                (2)
1A37    65 01    ADC $01     70 AC = AC
                                + C +
                                PEEK (1)
                             75 IF AC>255
                                THEN AC =
                                AC - 256:
                                C=1
1A39    85 02    STA $02     80 POKE AC,2
1A3B    A5 03    LDA $03     90 AC = PEEK
                                (3)
1A3D    69 00    ADC #0      100 AC = AC
                                + C
1A3F    85 03    STA $03     110 POKE 3, AC
1A41    CA       DEX         120 X = X - 1
1A42    D0 F0    BNE         130 IF Y <> 0
                                THEN 50
1A44    60       RTS         140 RETURN
```

Line 100 in the loader program for this reads:

```
100 DATA A6,00,A9,00,85,02,85,03,18,A5,02,
    65,01,85,02,A5
105 DATA 03,69,00,85,03,CA,D0,F0,60
```

After running this loader program press New — do not turn off — and try the following program — program 2.

```
10 INPUT "First number" ;A:A=(A and 255):
   POKE 0,A
20 INPUT "Second number" ;B:B=(B and
   255):
   POKE 1,B
30 SYS 6700
40 PRINT "A times B =";
50 PRINT PEEK (2) + 256 * PEEK (3)
60 GOTO 10
```

This program just takes all the hard work out of Poking and Peeking and should give the right answer.

Program 2 demonstrates the compare function and the pseudo-multiplication. The main aim of the program is to set a ball bouncing around the screen.

Figure 2 is the generalised flowchart and as we can see, the program is in three distinct sections.

For the ball to appear to bounce, it should move in straight lines, changing direction each time it reaches the edge of the screen. By using X and Y co-ordinates of the position, where X = 0 and Y = 0 at the top left-hand corner of the screen, checking if an edge has been reached is then a simple case of caring X with 0 or 22 and Y with 0 or 21.

The code of directions is:

(X = X - 1, Y = Y + 1) 4	top left
1 (X = X + 1, Y = Y + 1)	top right
(X = X - 1, Y = Y - 1) 3	bottom left
2 (X = X + 1, Y = Y - 1)	bottom right

The variable Direction can contain any number between 1 and 4 — figure 3.

Here it is handy to remember that theoretically for each edge there is only one direction of the ball with which that edge can be hit, and hence, only one direction with which the ball can leave. Whenever the ball strikes edge A, although its position on edge A may change, it will always strike edge A with the direction 2 and leave with direction 3, so as the ball bounces around the screen, the direction f the ball repeats as 1 -> 2 -> 3 -> 4 -> 1 -> 2 -> 3 -> 4 -> 1 etc. This makes life easier when programming. ■

(listing continued from page 155)

```
00052  1A79  E6 02          INC XPOS      ;420 XPOS=XPOS+1
00053  1A7B  E6 03          INC YPOS      ;430 YPOS=YPOS+1
00054  1A7D  4C 9A 1A       JMP CONT      ;440 GOTO580
00055  1A80  C9 02    BRNCH4 CMP #2       ;450 Z=0:IFA=2THENZ=1
00056  1A82  D0 07          BNE BRNCH5    ;460 IFZ=0THEN500
00057  1A84  E6 02          INC XPOS      ;470 XPOS=XPOS+1
00058  1A86  C6 03          DEC YPOS      ;480 YPOS=YPOS-1
00059  1A88  4C 9A 1A       JMP CONT      ;490 GOTO580
00060  1A8B  C9 03    BRNCH5 CMP #3       ;500 Z=0:IFA=3THENZ=1
00061  1A8D  D0 07          BNE BRNCH6    ;510 IFZ=0THEN550
00062  1A8F  C6 02          DEC XPOS      ;520 YPOS=YPOS-1
00063  1A91  C6 03          DEC YPOS      ;530 XPOS=XPOS-1
00064  1A93  4C 9A 1A       JMP CONT      ;540 GOTO580
00065  1A96  C6 02    BRNCH6 DEC XPOS     ;550 XPOS=XPOS-1
00066  1A98  E6 03          INC YPOS      ;560 YPOS=YPOS+1
00067  1A9A                              ;570 REM
00068  1A9A  A9 1E    CONT  LDA #$1E      ;580 A=30
00069  1A9C  85 01          STA PLOTHI    ;590 HIPLOT=A
00070  1A9E  A5 02          LDA XPOS      ;600 A=XPOS
00071  1AA0  85 00          STA PLOTLO    ;610 LOPLOT=A
00072  1AA2  A6 03          LDX YPOS      ;620 X=YPOS
00073  1AA4  18       BRNCH7 CLC          ;630 C=0
00074  1AA5  A5 00          LDA PLOTLO    ;640 A=LOPLOT
00075  1AA7  69 16          ADC #$16      ;650 A=A+C+22:IFA>=256THENA=A-25
6:C=1
00076  1AA9  85 00          STA PLOTLO    ;660 LOPLOT=A
00077  1AAB  A5 01          LDA PLOTHI    ;670 A=HIPLOT
00078  1AAD  69 00          ADC #$00      ;680 A=A+C+0
00079  1AAF  85 01          STA PLOTHI    ;690 HIPLOT=A
00080  1AB1  CA             DEX           ;693 X=X-1
00081  1AB2  D0 F0          BNE BRNCH7    ;696 IFX<>0THEN630
00082  1AB4  A0 00          LDY #$00      ;700 Y=0
00083  1AB6  A9 51          LDA #$51      ;710 A=81
00084  1AB8  91 00          STA (PLOTLO),Y ;720 POKE(LOPLOT+256*HIPLOT+Y),A
00085  1ABA                              ;730 REM
00086  1ABA  A5 02          LDA XPOS      ;740 A=XPOS
00087  1ABC  D0 07          BNE BRNCH8    ;750 IFA<>0THEN790
00088  1ABE  A9 02          LDA #$02      ;760 A=1
00089  1AC0  85 04          STA DIR       ;770 DIR=A
00090  1AC2  4C 50 1A       JMP LOOP      ;780 GOTO0150
00091  1AC5  C9 14    BRNCH8 CMP #$14     ;790 Z=0:IFA=21THENZ=1
00092  1AC7  D0 07          BNE BRNCH9    ;800 IFZ=0THEN840
00093  1AC9  A9 04          LDA #$04      ;810 A=2
00094  1ACB  85 04          STA DIR       ;820 DIR=A
00095  1ACD  4C 50 1A       JMP LOOP      ;830 GOTO150
00096  1AD0  A5 03    BRNCH9 LDA YPOS     ;840 A=YPOS
00097  1AD2  D0 07          BNE BRNCHA    ;850 IFA<>0THEN890
00098  1AD4  A9 01          LDA #$01      ;860 A=4
00099  1AD6  85 04          STA DIR       ;870 DIR=A
00100  1AD8  4C 50 1A       JMP LOOP      ;880 GOTO150
00101  1ADB  C9 14    BRNCHA CMP #$14     ;890 Z=0:IFA=22THENZ=1
00102  1ADD  D0 04          BNE BRNCHB    ;900 IFZ=0THEN930
00103  1ADF  A9 03          LDA #$03      ;910 A=2
00104  1AE1  85 04          STA DIR       ;920 DIR=A
00105  1AE3  4C 50 1A       JMP LOOP      ;930 GOTO150
00106  1AE6                              ;940 REM DELAY
00107  1AE6  A2 2F    DELAY LDX #$2F      ;950 REM SEE
00108  1AE8  A0 7F    BRNCHC LDY #$7F     ;960 REM PREVIOUS
00109  1AEA  88       BRNCHD DEY          ;970 REM ISSUES
00110  1AEB  D0 FD          BNE BRNCHD    ;980 REM
00111  1AED  CA             DEX           ;990 REM
00112  1AEE  D0 F8          BNE BRNCHC    ;1000 REM
00113  1AF0  60             RTS           ;1010 RETURN
00114  1AF1          ;
00115  1AF1          ;
00116  1AF1          ;
00117  1AF1                 .END
SYMBOL TABLE
SYMBOL VALUE
 BRNCH1   1A38   BRNCH2   1A3D   BRNCH3   1A5D   BRNCH4   1A80
 BRNCH5   1A8D   BRNCH6   1A96   BRNCH7   1AA4   BRNCH8   1AC5
 BRNCH9   1AD0   BRNCHA   1ADB   BRNCHB   1AE3   BRNCHC   1AE8
 BRNCHD   1AEA   CONT     1A9A   DELAY   1AE6   DIR      0004
 LOOP     1A50   PLOTHI   0001   PLOTLO   0000   XPOS     0002
 YPOS     0003
```

```
100 DATA a2,00,a9,20,9d,00,1e,9d,00,1f,ca,d0,f7,a2,00,a9,00,9d,00,96,9d
110 DATA 9d,00,97,ca,90,f7,86,03,a2,0f,86,02,a2,01,86,04,20,e6,1a,a9,1e
120 DATA 85,01,a5,02,85,00,a6,03,18,a5,00,69,16,85,00,a5,01,69,00,85,01
130 DATA CA,d0,f0,a9,20,a0,00,91,00,a5,04,c9,01,d0,07,e6,02,e6,03,4c,9a
140 DATA 1a,c9,02,d0,07,e6,02,c6,03,4c,9a,1a,c9,03,d0,07,c6,02,c6,03,4c
150 DATA 9a,1a,c6,02,e6,03,a9,1e,85,01,a5,02,85,00,a6,03,18,a5,00,69,16
160 DATA 85,00,a5,01,69,00,85,01,ca,d0,f0,a0,00,a9,51,91,00,a5,02,d0,07
170 DATA a9,02,85,04,4c,50,1a,c9,14,d0,07,a9,04,85,04,4c,50,1a,a5,03,d0
180 DATA 07,a9,01,85,04,4c,50,1a,c9,14,d0,04,a9,03,85,04,4c,50,1a,a2,2f
190 DATA a0,7f,88,d0,fd,ca,d0,f8,60
```

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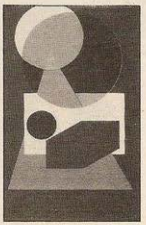

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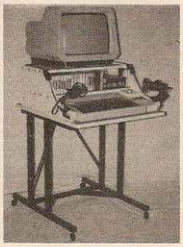

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RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

ZX CONVERSION

■I have just purchased a 16K ZX-81, and would like to know if it is possible to convert Spectrum programs for use on it. I am particularly interested in the Flight Simulator featured in your December 1982 issue.

Brendan J Fischer,
Kanagawa-ken,
Japan.

IN GENERAL, you cannot easily convert Spectrum programs containing any machine code to the ZX-81. Programs in Basic, which do not use Peek and Poke can be converted, after a fashion, although the ZX-81 version may well run — if it is a moving graphics program — too slowly to be satisfactory. You need to know exactly what the Spectrum program does, so that you will know how to substitute for such things as Screen$ and Attr. If you have just started programming your ZX-81, I would suggest you begin such conversions with short, text-only output programs.

CODE ADVICE

■Last year I purchased a Dragon 32 home computer and I am very happy with its Basic facilities and graphics. Now I feel that I have gone as far as I can in this language. The most obvious next step seems to be machine code — a subject that I know very little about. I have read several advertisements in *Your Computer* for Dragon machine-code aids, such as the package offered by J Morrison Software. This is where the problem arises — I have no idea what I should be looking for. For example what do I need from an editor, or an assembler, monitor, and disassembler. Can you advise me? Would I be better off buying a ROM cartridge or a cassette-tape version?

S Murray,
Yarm,
Cleveland.

PROBABLY THE most useful item on your list would be an assembler. By allowing you to enter a program in assembly language mnemonics, rather than as a series of numeric instructions, an assembler makes writing a machine-code program much easier. It also enables you to use labels and so saves you from the tedious business of keeping track of addresses and calculating relative jumps. A good assembler should also have an editor which will permit you to insert and delete program lines in the same way as you can edit a Basic program. The term editor is sometimes used in the same sense as the term monitor. As such it offers a range of functions which are useful in testing and debugging a program. These include facilities for displaying a block of memory, moving sections of code, and testing subroutines within a program. A disassembler simply translates machine code into assembly language. You might want to use one to examine the Operating System or other people's code. Ideally you could do with all these facilities but I would advise you at least to buy an assembler. For a monitor and disassembler you need go no further than key in the two programs printed in *Your Computer* for May of this year. There is no reason why a program on tape should not be as powerful as one on cartridge. A program in a ROM cartridge, however, has the advantage of being instantly available.

INCOMPATIBILITY

■Using my W H Smith computer-compatible cassette recorder with my ZX-81, I am able to Save and Reload my own programs. However, I cannot load either home-made or commercial programs containing an Autorun. Could you please advise how to overcome this?

D K Newby,
Teignmouth,
Devon,

THIS IS AN odd problem. The only thing I can think of which could cause this would be programs which save the Display file along with the program. This means a 1K program which was saved with a 16K RAM pack in place may well be 3.25K long — including the display file — and thus will not reload into a 1K machine. I assume you are correctly autosaving using the second to last line of your program as

```
SAVE "NAME"
```

and the final line as Run, then Saving the program by entering Goto as second to last line number.

TEACH AND PLAY

■In the near future I will be purchasing a computer. The two that interest me the most are the BBC model B and the Atari 800. Please can you advise me which you consider is the best choice for education and games needs.

Sunjoy Basu,
Coventry,
Warwickshire.

THE AVAILABLE software will really control your decision as to which computer you buy. Whereas the BBC machine is well supported with games and educational software, the Atari software is almost exclusively extremely good games. You will have to decide which need is paramount, and if you are not going to be writing all your own programs, let this need determine which machine you should buy.

LEARNING CODE

■I have heard that machine code is much better than Basic for producing speedy programs on the Spectrum. However, I am finding it very difficult to make sense of a book on the subject I bought. Is there a simple way to learn machine code . . . or at least a way to learn enough to be able to program some machine code into my Spectrum games?

Sandy Grant,
Fareham,
Hampshire.

A PRODUCT which may help you is called *Machine-code Test Tool* which is available from most bookshops. The product consists of a cassette and a little, 32-page booklet which explains how to use the program in order to give you practical examples, and hands-on experience of using machine code. Using this program, you can enter and test your own machine-code programs, as well as examine the Spectrum ROM. If you follow this booklet through carefully and carry out all the examples, you should be in a much stronger position to use machine code. MCTT is manufactured by Oxford Computer Publishing Ltd.

U.S. TRANSLATION

■I should be grateful if you could tell me whether a program recorded on a ZX-81 or Spectrum in Britain could be sent to the United States and work without modification on the corresponding machine.

J S Coombes,
Coventry,
Warwickshire.

CERTAINLY THEY CAN. The Load and Save aspects of the Sinclair computers have not been changed for the US, although the modulator to produce the television picture has, of course, been altered. The only fundamental difference between the computers here and there is that the TS-1000 — the US name for the ZX-81 — has 2K on board, rather than 1K of RAM as here; the TS-1500 has 16K on board; it is, I have been told, basically a 16K ZX-81 with a Spectrum-like keyboard; and the TS-82000 — the US Spectrum — will have some slightly different commands from the Spectrum. These are unlikely to affect your work. Full details of the TS-2000 keyboard were not available when we went to press.

ROM LINK

■I am thinking of buying a 4K graphics ROM for my ZX-81 and I am hoping that you can tell me more about it to set my mind at rest. Could you please tell me how it is connected to the computer and how the graphics are used in programs?

M Harvey,
Harlow,
Essex.

THE 4K ROM from Kayde takes about a quarter of an hour to fit, and needs a fine-tipped soldering iron. The ROM comes with five sheets of fitting instructions. There are eight sets of graphics, which are accessed by a single machine code call — such as

```
LET L = USR . . . or RAND USR . . .
```

The graphic sets are Sinclair graphics, faces and bodies, space invaders, upper and lower case text, Pac-Man graphics, asteroids, planes and miscellaneous. Adding a 2K RAM chip gives you access to four more sets of the graphics. Several programs have been written for use with the graphics ROM.

EXPERIMENTATION

■I am experimenting with the machine-Code routines on my 16K ZX-81, my problem is as follows: I wish to use two or more short machine-code routines within a Basic program. For the sake of this discussion let us presume that each routine is 20 bytes long and I wish to use two of them. I created a Rem statement 40 characters long and Poked both routines in one after the other, calling the first with Usr 16514 and the second with Usr 16534. The result was a crash. My next attempt was to use two Rem statements in different parts of the Basic program, this failed as I could find no way of Poking into the second Rem — or the first if it was not line 1. Can you please help?

Derek Harris,
Lower Wick,
Worcester.

IT CERTAINLY is possible to store two or more machine-code routines in the same Rem statement or in consecutive Rem statements. I imagine there must be an error in one of your routines. Possibly you have forgotten to end each routine with a RTS (96) instruction.

Another possibility if you are using two Rem statements is that you have not calculated correctly the start of the first free location in the second statement. Remember that the line number and Rem token take up five bytes at the start of the line; and there should also be a Newline character (118) at the end of the line. If, for example, the first Rem statement contains ten characters the address of the first free location in the second statement is 16530. ■

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Reversi

R M Francis,
Brentwood,
Essex.

SPECTRUM

WRITTEN FOR A 16K machine to provide a game which is very fast when the computer is choosing its move, this is also proof against an incorrect entry by the person playing. The speed has been achieved by a machine-code routine and the error prevention by a considerable degree of checking by the Basic program.

In addition there are two levels of play available; at the lower level the computer merely maximises the number of its opponent's positions which it captures; at the higher level it also considers the relative merits of the position which it will occupy with its own move.

The structure of the Basic program is as follows:

20	subroutine to convert the current board positions to an address table for use by the machine-code routine
30-120	subroutine to update current positions when a move has been selected
130-320	subroutine to print board with current positions
330-370	subroutine to initialise start positions
380-520	introduction and initialisation
530-630	computer's move including call for machine-code program
640-800	player's move including checks on legality
810-910	print result of game and restart if required

This should be entered first and saved on tape using the self-start facility, the command should be

SAVE "Reversi" LINE 10

When this has been Verified the computer should be Newed and the command

CLEAR 31999

entered. The 465 bytes of machine code should be entered using the following program:

```
10 LET s=0
20 FOR n=32111 TO 32575
30 INPUT b
40 POKE n,b
50 LET s=s+b
60 PRINT n; TAB 10;b; TAB 20;s
70 NEXT n
```

The purpose of lines 10 and 50 is to provide a sumcheck of the machine-code entry; when all the machine code has been entered the sumcheck total should be 56695. To ensure that you are on the right track the intermediate checks are as follows:

After the byte for address 32200 has been entered the total should be 11300 and after 32300 has been entered the total should be 25851. After 32400, the total should be 35956, and after 32500, the total should be 47032.

When this has been entered, and the sumcheck found to be correct then save it after the Basic program with the command

SAVE "mcode"CODE 32111,465

Once this has been Verified the whole program can be loaded from the beginning. The self-starting Basic program will automatically load the machine code. From then on everything should be self-explanatory.

```
  1 LPRINT CHR$ (5);CHR$ (27);CHR$ (33);CHR$ (8);CHR$ (4);
  2 STOP
 10 GO TO 380
 20 FOR b=1 TO 10: FOR c=1 TO 10: POKE (32000+(b-1)*10+c),a(b,c): NEXT c: NEXT
b: RETURN
 30 FOR b=-1 TO 1
 40 FOR c=-1 TO 1
 50 LET d=0: LET e=0
 60 IF a(d+b,e+c)>0 THEN GO TO 80
 70 LET d=d+b: LET e=e+c: GO TO 60
 80 IF a(d+b,e+c)<0 THEN GO TO 120
 90 IF a(d,e)=0 THEN GO TO 120
100 LET a(d,e)=t: IF d=0 AND n=0 THEN GO TO 120
110 LET d=d-b: LET e=e-c: GO TO 90
120 NEXT c: NEXT b: RETURN
130 PRINT AT 0,12;"REVERSI"
140 PRINT AT 2,0;"I a playing 'X' - "
150 PRINT TAB 14;"you re playing 'O'"
160 LET z=4
170 LET g=0: LET h=0
180 PRINT AT (z-1),19;" 12345678 "
190 FOR b=2 TO 9: PRINT AT (b+z),19;CHR$ (b+95);
200 FOR c=2 TO 9
210 IF a(b,c)=0 THEN PRINT " ";
220 IF a(b,c)=1 THEN PRINT "o";
230 IF a(b,c)=f THEN PRINT ".";
240 IF a(b,c)=1 THEN LET g=g+1
250 IF a(b,c)=0 THEN LET h=h+1
260 NEXT c
270 PRINT CHR$ (b+95)
280 NEXT b
290 PRINT AT (z+10),19;" 12345678 "
300 IF g=h=64 THEN GO TO 810
310 PRINT : PRINT TAB 5;"I have ";g;" ";you have ";h;".    "
320 RETURN
330 FOR b=1 TO 10: FOR c=1 TO 10
340 IF b<>1 AND c<>1 AND b<>10 AND c<>10 THEN LET a(b,c)=f
350 NEXT c: NEXT b
360 LET a(5,5)=x: LET a(6,6)=x: LET a(6,5)=o: LET a(5,6)=o
370 RETURN
380 CLEAR 31999: POKE 23609,75: LOAD ""CODE : CLS
390 PRINT AT 11,0;"Don't forget to stop the tape"
400 DIM a(10,10): LET z=6*    "; LET f=46: LET j=0: LET k=48: LET o
=111: LET x=0: LET w=57: LET w=k+u: LET x=120
410 PRINT AT 20,0;"Press any key to start": IF INKEY$="" THEN GO TO 410
420 CLS : PRINT AT 11,0;"Please wait a moment": GO SUB 330: GO SUB 20
430 CLS : PRINT AT 10,3;"In this game of 'REVERSI'    there are two levels of p
lay.";AT 13,3;"Do you want to play the     easier game (ENTER 1) or the     hard
er one (ENTER 2)?"
440 INPUT i: IF i<1 OR i>2 THEN GO TO 440
450 IF i=1 THEN POKE 32528,0: POKE 32529,0: POKE 32530,0: GO TO 470
460 POKE 32528,205: POKE 32529,173: POKE 32530,125
470 CLS : PRINT AT 0,12;"REVERSI"
480 PRINT AT 2,2;"You make your move by enteringthe letter down the side and th
enumber across the top, for     examples: 'd4' or 'b8'"
490 LET z=4: GO SUB 170
500 INPUT "Do you want to go first?          (Y or N) ";g$
510 CLS : GO SUB 130
520 IF g$<>"n" AND g$<>"N" THEN GO TO 640
530 PRINT AT 10,4;" My move ";AT 12,0;z$;AT 13,0;z$
540 LET s=z: LET t=z
550 RANDOMIZE
560 LET r=USR 32445
570 IF r<0 AND r=0 THEN GO TO 810
580 IF i=1 THEN PAUSE 50: BEEP .25,25: BEEP .25,20: PRINT AT 10,5;"I can't";AT
11,5;"go"; PAUSE 75: GO TO 640
590 LET i=i-32000
600 LET m=INT (i/10)
610 LET n=i-m*10: LET a=m+1
620 BEEP .25,25: BEEP .25,20: PRINT AT (4+m),(n+18); FLASH 1;"o"
630 GO SUB 30: GO SUB 20: BEEP .25,25: BEEP .25,15: GO SUB 160
640 PRINT AT 10,4;"Your move";AT 11,0;z$;AT 12,1;"If you can't go";AT 13,4;"ent
er 'pg'"
650 LET s=x: LET t=o
660 INPUT p$: IF LEN p$<>2 THEN PRINT AT 19,0; FLASH 1;"You're move should be s
ade by"; FLASH 0;"  "; FLASH 1;"entering 2 characters not ";LEN p$: GO TO 660
670 IF p$="pg" OR p$="PG" THEN LET r=0: GO TO 750
680 IF (CODE p$>k AND CODE p$<u AND p$(2)<CHR$ k AND p$(2)<(CHR$ u) OR (CODE p$>
k AND CODE p$<u AND p$(2)>CHR$ v AND p$(2)<CHR$ w) THEN GO TO 700
690 PRINT AT 19,0; FLASH 1;p$;" isn't on the board; try again"; PRINT z$;z$: GO
TO 660
700 IF CODE p$>k AND CODE p$<u AND p$(2)>CHR$ v AND p$(2)<CHR$ w THEN LET p$=p$
(2)+p$(1)
710 LET m=CODE p$-95: LET n=VAL p$(2)+1: LET r=(m-1)*10+n-1
720 IF a(m,n)<>f THEN GO TO 800
730 LET j=0
740 GO SUB 30: IF j<1 THEN GO TO 790
750 PRINT AT 19,0; FLASH 0;z$;z$
760 PRINT FLASH 0;z$;z$: IF r=0 THEN GO TO 530
770 BEEP .25,25: BEEP .25,20: PRINT AT (4+m),(n+18); FLASH 1;"o"
780 GO SUB 20: BEEP .25,25: BEEP .25,15: GO SUB 160: GO TO 530
790 LET a(m,n)=f
800 PRINT AT 19,0; FLASH 1;"You cannot go at ";p$;"; try again"; FLASH 0;"  ";
PRINT FLASH 0;z$;z$: GO TO 660
810 PRINT AT 10,0;z$;AT 12,0;z$;AT 13,0;z$;AT 14,0;z$;z$
820 IF g>h THEN PRINT AT 18,0;"I won, ";g;" - ";h
830 IF g<h THEN PRINT AT 18,0;"You won, ";h;" - ";g
840 IF g=h THEN PRINT AT 18,0;"It's a draw: ";g;" - ";h
850 INPUT "Would you like another game?  (Y or N) ";y$
860 IF y$="y" OR y$="Y" THEN STOP
870 CLS : PRINT AT 11,0;"Please wait a moment": GO SUB 330: GO SUB 20
880 CLS : INPUT "Which level do you want to play (1 or 2)? ";i
890 IF i<1 OR i>2 THEN GO TO 880
900 IF i=1 THEN POKE 32528,0: POKE 32529,0: POKE 32530,0: GO TO 500
910 POKE 32528,205: POKE 32529,173: POKE 32530,125: GO TO 500
```

32111	62	50	190	208	62	32191	202	134	126	254	87	32271	202	142	126	254	88
32116	115	190	56	8	58	32196	202	142	126	254	86	32276	40	126	254	83	40
32121	107	125	60	50	107	32201	202	142	126	254	85	32281	122	254	79	40	118
32126	125	201	58	106	125	32206	202	142	126	254	84	32286	254	78	40	114	254
32131	33	107	125	134	50	32211	202	142	126	254	69	32291	77	40	110	254	76
32136	106	125	201	62	0	32216	202	142	126	254	62	32296	40	106	254	75	40
32141	50	107	125	125	145	32221	202	142	126	254	59	32301	102	254	74	40	98
32146	111	205	111	125	62	32226	202	142	126	254	52	32306	254	73	40	94	254
32151	111	190	40	245	201	32231	202	142	126	254	49	32311	72	40	90	254	68
32156	62	0	50	107	125	32236	202	142	126	254	42	32316	40	86	254	63	40
32161	125	129	111	205	111	32241	202	142	126	254	39	32321	82	254	58	40	78
32166	125	62	111	190	40	32246	202	142	126	254	32	32326	254	53	40	74	254
32171	245	201	125	254	89	32251	202	142	126	254	17	32331	48	40	70	254	43
32176	202	134	126	254	82	32256	202	142	126	254	16	32336	40	66	254	38	40
32181	202	134	126	254	19	32261	202	142	126	254	15	32341	62	254	33	40	58
32186	202	134	126	254	12	32266	202	142	126	254	14						

(continued on page 165)

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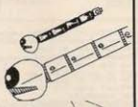

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Access

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(continued from page 163)

```
32346  254  29  40  54  254
32351  28  40  50  254  27
32356  40  46  254  26  40
32361  42  254  25  40  38
32366  254  24  40  34  254
32371  23  40  30  254  22
32376  40  26  254  18  40
32381  22  254  13  40  18
32386  58  106  125  201  58
32391  106  125  203  39  203
32396  39  201  58  106  125
32401  203  39  201  58  106
32406  125  60  203  47  201
32411  237  75  118  92  205
32416  43  45  239  161  15
32421  52  55  22  4  52
32426  128  65  0  0  128
32431  50  2  161  3  49
32436  56  205  162  45  237
32441  67  118  92  201  62
32446  0  50  105  125  50
32451  108  125  50  109  125
32456  6  78  33  11  125
32461  120  133  111  62  46
32466  190  32  100  229  62
32471  0  50  106  125  14
32476  11  205  139  125  225
32481  229  205  156  125  225
32486  229  13  205  139  125
32491  225  229  205  156  125
32496  225  229  13  205  139
32501  125  225  229  205  156
32506  125  225  229  14  1
32511  205  139  125  225  229
32516  205  156  125  225  229
32521  58  106  125  254  0
32526  40  40  0  0  0
32531  33  105  125  190  56
32536  31  32  17  245  197
32541  229  205  155  126  33
32546  0  78  167  237  66
32551  56  12  225  193  241
32556  50  105  125  225  34
32561  108  125  24  4  225
32566  193  241  225  16  143
32571  237  75  108  125  201
```

Drawing program

Christopher Stops,
Bridgwater,
Somerset.

ZX-81

HERE IS A drawing program for the 1K ZX-81. Because the program is in compact machine code, almost the whole screen is available. It is not necessary for me to write all the usual advice and directions such as the machine code loader program. Here is some information you will require: type in line 10 as a Rem statement followed by 126 Xs. Then you must use a hexadecimal loader to enter the code in to the hex listing. Line 0 should be 20 Rand Usr 16514. The controls are 1 left, 2 down, 3 up, 4 right, 5 to change printer character, Shift to stop the program. The background shade is set at 16527 — set as 0, or a white background. As the program stands the whole character set is available, but if one requires the graphics symbols only, just

POKE 16595,11

and

POKE 16601,139

Because of the way the code works, to move south-east, just press 2 and 4 together that is down and right. To erase, select the same print character as the background. This also applies to moving the cursor. The cursor's position is always clear because it is printed as an X for a fraction of second each time the program goes round. Do not print an asterisk unless you are sure you want it there, because these mark the border and are erasable. The border is marked to stop someone printing over the Newline characters and crashing the program.

ZX-81 drawing program

```
16514  3E  17  06  20  D7
16519  10  FD  0E  12  D7
16524  06  1E  3E  00  D7
16529  10  FD  3E  17  D7
16534  0D  20  F2  05  20
16539  D7  10  FD  2A  0C
16544  40  11  23  00  19
16549  E5  CD  BB  02  7C
16554  E1  44  4D  CB  47
16559  C8  11  21  00  CB
16564  4F  20  01  28  CB
16569  57  20  01  19  CB
16574  5F  20  04  C5  00
16579  ED  52  CB  67  20
16584  01  23  CB  6F  20
16589  13  3A  21  40  3C
16594  FE  40  20  02  3E
16599  80  FE  C0  20  02
16604  3E  00  32  21  40
16609  7E  FE  17  20  02
16614  60  69  36  3D  01
16619  00  05  0B  78  B1
16624  20  FB  3A  21  40
16629  77  01  00  10  08
16634  78  B1  20  FB  18
16639  A5  76  00  14  2D
```

Data Base

M Maynard,
Edinburgh.

BBC

DATA BASES are used a lot, especially in business, but for a full system disc drives are essential. This program I have written contains many of the facilities of a professional system, except it is designed for a BBC Micro with cassette and a printer.

The program will run on a BBC computer model B. It will just run on a model A, but to make any use of it you would have to use mode 7. This has no real disadvantage — I just prefer mode 6. The program uses about 7K, with screen memory of 8K. You can set up new file or add to existing file. This option can be used to create a new file or add to a file in memory. The computer asks you if you want to set up a new file. If you answer yes it warns you that any file already in memory will be erased. If you opt to continue you are asked for the approximate number of items in the file. The computer will then add an extra 10 percent, in case you underestimate. The next stage is to input the data. The information will always be sorted with the first letter most significant — this should be borne in mind if a page number is part of the entry. To finish enter

"$$$"

and this will return you to the menu. If you want to add to an existing file it checks space and then tells you the maximum number of items you can add. You then proceed as you would if you created a new file.

The Check file memory option allows you to check each of the entries and then, if they are wrong to alter, or delete them. The computer

(continued on page 167)

BBC data program

```
  10 ON ERROR IF ERR=17 GOTO 30 ELSE REPORT:PRINT" at line ";ERL:END
  20 REM ***** DATA BASE SYSTEM *****
  30 MODE6
  40 PRINT TAB(10,2)"MASTERFILE";TAB(10,3)STRING$(10,"-")
  50 PRINT''"OPTIONS:"
  60 PRINT"1)....Set up new file/add to old file."
  70 PRINT"2)....Check file in memory."
  80 PRINT"3)....Set up Printer."
  90 PRINT"4)....Sort file in memory."
 100 PRINT"5)....Print file."
 110 PRINT"6)....Load file from tape."
 120 PRINT"7)....Save file to tape."
 130 PRINT"8)....Find an item in the file."
 140 PRINT"9)....End Program."
 150 PRINT''"Enter option: ";
 160 OP$=VAL(GET$):IF OP$=0 PRINT''"INPUT ERROR!"''"Hit any key to continue...";:
WAIT$=GET$:GOTO 30
 170ON OP$ GOSUB 190,540,730,870,1090,1260,1490,1640,1840
 180 GOTO 30:REM RE-PRINT MENU AFTER OPTION
 190 REM ***** SET UP NEW FILE/ADD TO OLD *******
 200 CLS:PRINTTAB(7,2)"SET UP OR ADD TO FILE"TAB(7,3)STRING$(21,"-")
 210 PRINT''"New file (Y/N)?";:IN$=GET$
 220 IF IN$="N" THEN 410 ELSE IF IN$<>"Y" THEN PRINT''"INPUT ERROR!!"''"Hit any
key to continue.....";:WAIT$=GET$:GOTO 200
 230 PRINT''"You will erase the file currently in"''"memory-do you wish to do th
is (Y/N)?";:IN$=GET$
 240 IF IN$<>"Y" THEN 30
 250 CLS:PRINT TAB(6,2)"SET UP NEW FILE"TAB(6,3)STRING$(15,"-")
 260 CLEAR
 270 INPUT''"File name:"NM$
 280 IF LEN(NM$)<1 OR LEN(NM$)>10 THEN PRINT''"ILLEGAL NAME!!"''"Press any key t
o continue...";:WAIT$=GET$:GOTO 250
 290 INPUT"Approximate number of items in file:",NO
 300 IF NO<1 THEN PRINT"INPUT ERROR!!!"''"Hit any key to continue...";:WAIT$=GET
$:GOTO 290
 310 NO=NO+(NO/10):REM ALLOW 10% INACCURACY
 320 DIM DT$(NO):LGTH=0
 330 PRINT''"Input items in file:"''"Remember that thefile will be sorted"''"with
the first letter most significant."''"Enter '$$$' to finish."
 340 REPEAT
 350 INPUTLINE"Item:"IN$
 360 IF IN$(>"$$$" THEN LGTH=LGTH+1:DT$(LGTH)=IN$
 370 UNTIL IN$="$$$" OR LGTH=NO
 380 PRINT''"END:Check data (enter 'Y' or 'N')";:IN$=GET$
 390 IF IN$="Y" THEN GOSUB 540
 400 GOTO 180
 410 REM ***** ADD ITEMS *****
 420 CLS:PRINT TAB(10,2)"ADD MORE ITEMS"TAB(10,3)STRING$(14,"-")
```

(listing continued on page 167)

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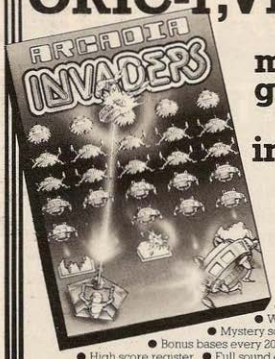

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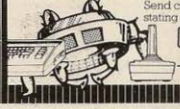

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(continued from page 165)

first prints out the title and asks you if it is correct. If it is not it will then input the correct version. The computer then displays each entry and asks you if they are correct. You can then press Return if you wish it to remain as it is or you can press the space bar to delete it. If you want to change it you just type the correct version. The cursor and copy keys can be used for this. If you wish to return to the menu before the end just press Escape.

The set up printer option will configure the system for the printer you are using. The computer asks first whether you are using a serial or parallel printer. If you are using a serial printer you are shown the different baud rates that the micro uses. You must then input the rate you wish to use. The computer then performs an Osbyte call to set the speed up. This is because you cannot use variables in a *FX command.

The next option will sort the file that is currently in memory. It uses a bubble sort. This becomes quite slow if you have many items in the file, but the speed is acceptable for home use. You have the option of sorting only a part of the file or all of it.

The Print the file option prints out the file in order. It asks you if you want to use a printer and if you want to use paging. If you opt to use paging the computer reminds you that you need to press Shift key after each page. The computer will then print out the title, number of items and each entry. If you use the printer the instructions and questions will not be printed.

The sixth option will load a data file from tape, or give you a catalogue of the tape. If you just want to get a catalogue of the tape you press the Return key when asked for the name of the file. If you wish to load a file type its name when asked. The computer will then ask you to position the tape and press Return. When the computer finds the file it tells you how many items there are in the file and asks you how much extra space you want. This is to enable you to save a half-finished file and to load it later to complete it. When loading the computer prints loading so that you know all is well. When finished the computer asks you to press a key and then it returns you to the menu.

The Save-a-file option allows you to save a data file on cassette. It tells you to position the cassette at a spare section and then press Return. The computer then places the information on the tape and, when finished, asks you to press any key to return to the menu. To find out if you have a 0.1 operating system tape

```
*FX0
```

The reason you need this program is because the computer may corrupt the data as it sends it to the cassette.

The eigth option enables you to list all the entries in the file with a certain string in them. The instance you could have a file of all the articles in a magazine. For articles which have a program you could add

```
(Prog)
```

to the entry. Then, to find all the articles with a program you enter

```
Prog
```

as your search string. The routine finds substrings. There is an option to have the items that are found put on the printer, or on the screen.

The End-the-session option will end the program and return you to Basic. It would be possible to return to the program without losing the data, but you would have to use

```
GOTO 10
```

instead of Run.

(listing continued page 165)

```
430 IF LGTH=NO THEN PRINT"'You have added the maximum amount.""Press any key
to continue....";:GET$:GOTO 50
440 PRINT"'You can add only ";NO-LGTH;" items."
450 PRINT"'You will have to stop when you exceed ";NO;" This number.To finish befo
re this take""999 as an entry."
460 PRINT"
470 LGTH=LGTH+1
480 INPUT"Item ";ITM$
490 IF ITM$="999" THEN DTM$(LGTH)=ITM$ ELSE LGTH=LGTH-1
500 IF ITM$="999" AND LGTH=0 AND THEN 470
510 IF ITM$="999" THEN PRINT"O.K." ELSE PRINT"No more items may be entered."
520 PRINT"Press any key to continue....";:GET$:GOTO 50
530 GOTO 30
540 REM ****** CHECK FILE IN MEMORY ******
550 CLS:PRINT TAB(7,2)"CHECK FILE ROUTINE"TAB(7,3)STRING$(18,"-")
560 PRINT"'This will check each record.You can    start and finish at any re
cord.""Is the name of the file is ";LGTH
570 PRINT"'Is this correct?";:INK=GET$
580 IF INK=89 THEN INPUT"'Correct name ";NM$ ELSE IF INK=78 THEN PRINT"'INP
UT ERROR!!!""Press any key to continue...";:GET$:GOTO 550
590 IF LEN(NM$)<1 OR LEN(NM$)>10 THEN PRINT"'ILLEGAL NAME!!!""Press any key to
continue....";:GET$:GOTO 550
600 PRINT"'" Each item will be printed.If you wish  to change it type the cor
rect version.If you wish to delete it press the "SPACE BAR".If you want it to re
main as it is press "RETURN".
610 X=0
620 FOR A=1 TO LGTH
630 PRINT TAB(10,22)POS(X)
640 PRINT TAB(10,22)DTM$(A)
650 XL=LEN(DTM$(A))
660 INKGET:IF INK=13 THEN 710
670 IF INK=32 THEN DTM$(A)=CHR$(255):GOTO 710
680 PRINT CHR$(INK);:INPUTLINE"";DTM$(A)
690 DTM$(A)=CHR$(INK)+DTM$(A)
700 PRINT TAB(6,23)POS(X)CLEOL(DTM$(A))
710 NEXT
720 RETURN
730 REM ****** SET UP PRINTER *******
740 CLS:PRINT TAB(7,2)"PRINTER SET-UP"TAB(7,3)STRING$(14,"-")
750 INPUT"Printer line length (80=default)";NO:WIDTH NO
760 INPUT"Serial or Parallel";IOB:IOB=LEFT$(IOB,1)
770 IF IOB="P" THEN RETURN ELSE IF IOB="S" THEN PRINT"'INPUT ERROR!!!""Hit an
y key to continue...";:GET$:GOTO 730
780 PRINT"'Which baud rate?(rates available are:"
790 RESTORE 800:FOR A=1 TO 8:READ BOL,TEMP$:PRINT BOL;:NEXT
800 RESTORE 860
810 INPUT"Rate";BOL
820 READ BOL,PX
830 IF BOL=1800 THEN RW=0:XW=0:CALL 1FF04 RETURN
840 IF BOL>9999 THEN 820
850 PRINT"ERROR-NO SUCH RATE!!""Hit any key to continue.....";:INK=GET$:GOTO
730 REM RE-SET ALL PARIMETERS
860 DATA 75,150,300,600,1200,2400,4800,9600
870 REM ****** SORT FILE IN MEMORY *****
880 CLS:PRINT TAB(5,2)"SORT INTO ROUTINE"TAB(5,3)STRING$(17,"-")
890 PRINT"'Do you wish to sort all of the file?""Enter"Y"or"N"?";
INK=GET$
900 IF INK=89 THEN GOTO 1050 ELSE IF INK=78 THEN PRINT"'INPUT ERROR!!" GOTO 8
50
910 INPUT"'Which item to start sort from";ST
920 INPUT"'Which item to end sort at";EN
930 REM BUBBLE SORT
940 REPEAT
950 FL=0
960 FOR A=ST TO EN-1
970 IF DTM$(A)>DTM$(A+1) THEN 990
980 X$=DTM$(A):DTM$(A)=DTM$(A+1):DTM$(A+1)=X$:FL=1
990 NEXT
1000 UNTIL FL=0
1010 FOR A=1 TO LGTH
1020 IF DTM$(A)=CHR$(255) THEN DTM$(A)=""
1030 NEXT A
1040 RETURN
1050 REM SORT ALL NUMBERS
1060 ST=0
1070 EN=LGTH
1080 GOTO 930
1090 REM ****** PRINT FILE *******
1100 CLS:PRINT TAB(7,2)"PRINT FILE ROUTINE"TAB(7,3)STRING$(18,"-")
1110 PRINT"'Do you wish to use the printer (Y/N)?";PR$=GET$
1120 IF PR$="Y" AND PR$="N" THEN PRINT"'INPUT ERROR!!!""Hit any key to conti
nue.....";:GET$:GOTO 1090
1130 PRINT"'Do you want to use paging?";:PG$=GET$
1140 IF PG$="Y" THEN PRINT"'Will ask you to press "SHIFT" when the end of a page i
s reached.""'YOU 14 ELSE IF PG$="N" THEN PRINT"'INPUT ERROR!!!""Hit any key t
o continue....";:GET$:GOTO 1090
1150IF PR$="Y" THEN IOB=2
1160 PRINT"'TAB(5,7)"Title :-"SPC(3)NM$:TAB(5,9)STRING$(9,CHR$(34)+"-")
1170 PRINT"'Number of items ";LGTH
1180 PRINT"'Items ""-------"
1190 FOR A=1 TO LGTH
1200 PRINT"'";DTM$(A)
1210 NEXT A
1220 IF PG$="Y" THEN VDU3
1230 IF PG$="Y" THEN VDU15
1240 PRINT"'Press any key to return to menu....";:GET$:GOTO
1250 RETURN
1260 REM ****** LOAD FILE FROM TAPE ****
1270 CLS:PRINT TAB(7,2)"LOAD FILE ROUTINE"TAB(7,3)STRING$(17,"-")
1280 CLS:PRINT
1290 PRINT"'To obtain a catalog of the tape type    "RETURN".When finished hit
ESCAPE" to return to the menu."
1300 INPUT"'File name ";NM$
1310 IF LEN(NM$)=0 THEN 1320
1320 *CAT
1330 IF LEN(NM$)>10 THEN PRINT"'ILLEGAL NAME!!!""Press any key to continue....
";:GET$:GOTO 1290
1340 PRINT"'Insert tape.Position before the file andPress "RETURN"."
1350 *LOAD
1360 REPEAT UNTIL GET=13
1370 X=0
1380 ON ERROR=PROCERROR:
1390 INPUT#CHN,LGTH
1400 PRINT"'Number of items ";LGTH:INPUT"Extra space:";EX:IF ERR=0 PRINT"Input e
rror!!!":GOTO 1480 ELSE NO=LGTH+EX
1410 DIMDTM$(NO)
1420 PRINT"'Loading"
1430 FOR A=1 TO LGTH
1440 INPUT#CHN,DTM$(A)
1450 NEXT
1460 *FX5,0
1470 VDU3:PRINT"'"Finished-Hit any key to return to menu....";:GET$:GOTO
1480 GOTO 1490
1490 REM ****** SAVE FILE TO TAPE ******
1500 CLS
1510 PRINT TAB(7,2)"SAVE FILE ROUTINE"TAB(7,3)STRING$(17,"-")
1520 PRINT"'Insert tape and position at start of    spare section.Press "RETUR
N" when ready."
1530 *LOAD
1540 REPEAT UNTIL GET=13
1550 X=0
1560 CHN=OPENOUT(NM$)
1570 PRINT#CHN,LGTH
1580 FOR A=1 TO LGTH
1590 PRINT#CHN,DTM$(A)
1600 NEXT
1610 CLOSE#CHN
1620 PRINT"'"Finished-Hit any key to return to the    menu....";:GET$:GOTO
1630 RETURN
1640 REM ****** FIND ME ITEM ******
1650 CLS:PRINT TAB(7,2)"FIND ROUTINE"TAB(7,3)STRING$(12,"-")
1660 PRINT"'"The Program will find every occurrence of the item even in the middl
e of an entry.""e.g. it would find "BBC" in the BBC Computer"
1670 INPUT"'Item ";ES$
1680 PRINT"'"Search returned:" PR$=GET$
1690 IF PR$="Y" THEN VDU3:X=0 ELSE IF PR$="N" THEN PRINT"'INPUT ERROR!!!""Hit any
key to continue....";:GET$:GOTO 1680
1700 PRINT"'"Search item ";ES$
1710 FF=FALSE
1720 FOR A=1 TO LGTH
1730 TEST$=A
1740 IF LEN(TEST$)<LEN(ES$) THEN 1790
1750 FOR B=1 TO LEN(TEST$)-LEN(ES$)
1760 XS$=MID$(TEST$,B,LEN(ES$))
1770 IF XS$=ES$ PRINT DTM$(A):A=FF:TRUE
1780 NEXT B
1790 NEXT A
1800 IF FF=FALSE PRINT"No items under that name found"
1810 IF PR$="Y" THEN VDU3
1820 PRINT"'Hit any key to return to menu....";:GET$:GOTO
1830 RETURN
1840 REM ****** END PROGRAM *******
1850 CLS:PRINT TAB(10,10)"BYEEE!!!ee.
1860 END
```

Astrogladiator

P Edmond,
Driffield,
East Yorkshire.

VIC-20

YOU HAVE two minutes in which to destroy as many alien gladiators as possible in the cosmic arena. The game is intended for use with an unexpanded Vic-20. Do not insert unnecessary spaces into the program lines when entering the game since virtually all the memory of an unexpanded Vic is consumed.

Use the full stop and comma keys to rotate your ship clockwise and anti-clockwise, use the question mark key to fire and the Shift and Commodore keys to move your ship at various speeds. This game is probably the first to use an enlarged screen window on an unexpanded Vic. The stellar background covers your entire television screen due to a memory map of 1,008 bytes — 28 by 36.

(continued on next page)

(continued from previous page)

You may have tried enlarging the screen size by Poking locations 36866 and 36867 but without extra memory added to your Vic the memory map of the screen runs past 8192 and there is no information as to what to put on the screen, resulting in jumbled characters.

In this program, though, before increasing the screen size, 128 is subtracted from location 36866 so that the screen map starts at 7168 instead of 78680, leaving 1K for screen memory.

Juggling 36866 and 36867 again gives a screen size of 28 across by 36 down which is centred on the television screen by Poking locations 36864 and 36865.

A user-defined graphics/character set is fitted between 6144 and 7168, explaining why the program is so short — there is only 2K of memory left. If you are wondering what

PEEK (633)

is in line 36, it simply determines what combination of Shift, Commodore or Ctrl keys are being pressed.

```
 1 POKE56,24:POKE52,24:CLR:GOSUB9000:POKE36879,8:PRINTCHR$(8):P=30720:D(6)=29
 2 VS=36877:VI=36878:POKEVI,15:L=0:D(1)=-1:D(2)=-29:D(3)=-28:D(4)=-27:D(5)=1
 3 D(7)=28:D(8)=27:W(1)=64:W(2)=77:W(3)=93:W(4)=78:W(5)=64:W(6)=77:W(7)=93
 4 POKE36866,28:POKE36867,72:POKE36864,7:POKE36865,19:POKE648,28:PRINT"J"
 5 POKE648,30:PRINT"J":FORI=0TO5:POKE7674+I,32:POKE7674+R+I,1:NEXT:W(8)=78
 6 F=7680:R=1:U1=32:U=7800:R1=1:FORI=1TO99:POKEF7168+RND(1)*1008,74+RND(1)*2
 7 NEXT:P1=32:FORI=1TO15:POKE7168+RND(1)*1008,76:NEXT:TI$="000000"
 30 T=PEEK(197):Q=0:IFT=29THENQ=-1:POKEVS-1,225
 32 IFT=37THENQ=1:POKEVS-1,227
 33 IFT=30THEN100
 34 R=R+Q:IFR<1THENR=8
 35 POKEVS-1,0:IFR>8THENR=1
 36 POKEP,P1:P=P+PEEK(653)*D(R):IFP>8176THENF=F-1008
 37 IFP<7168THENP=P+1008
 38 P1=PEEK(P):POKEP,65+R:POKEP+A,7:IFP1=65+R1THEN200
 40 IFRND(1)>.6THENR1=R1+INT(RND(1)*3)-1:POKEVS,235+RND(1)*18
 42 IFR1<1THENR1=8
 43 IFR1>8THENR1=1
 44 POKEVS,0:POKEU,U1:U=U+D(R1):IFU>8176THENU=U-1008
 45 IFU<7168THENU=U+1008
 46 U1=PEEK(U):POKEU,65+R1:POKEU+A,5:IFU1=65+R1THEN200
 49 IFTI$<"000200"THEN30
 50 PRINT"%%TIME'S UP ! ";
 51 PRINT"                    'YOU SCORED"SC:SC=0:FORI=1TO3000:NEXT:WAIT197,63:GOTO2
 100 IFF<>0THEN110
 102 Y=D(R):F1=R+65:F=P:L=0:K=R:G=PEEK(36868)OR128
 110 POKEVS-1,G:F=F+Y:F1=PEEK(F):POKEF,W(K)
 111 IFF<7168ORF>8176THENPOKEF,F1:F=0:POKEVS-1,0:GOTO34
 120 POKEVS-1,0:IFF1=R1+65THEN132
 121 L=L+1:IFL=12THENPOKEF,F1:F=0:GOTO34
 122 POKEF,F1:GOTO110
 129 POKEU,42:FORI=1TO4:FORJ=1TO8:POKEU+D(J)*I,RND(1)*2+74:POKEVS,220+J*3:NEXTJ,I
 130 FORI=1TO4:FORJ=1TO8:POKEU+D(J)*I,32:POKEVI,15-I*3:NEXTJ,I
 131 POKEVS,0:POKEVI,15:POKEU,32:U=7168+INT(RND(1)*28):U1=32:F=0:R1=INT(RND(1)*8
+1):RETURN
 132 GOSUB129:SC=SC+1:FORI=1TO10:POKE7168+RND(1)*1008,RND(1)*2+74:NEXT:GOTO34
 200 GOSUB129:PRINT"%% YOU COLLIDED";:GOTO51
 9000 FORI=0TO1023:POKE6144+I,PEEK(32768+I):NEXT:POKE36869,254:FORI=0TO87:READA
 9010 POKE6672+I,A:NEXT:RETURN
 9020 DATA0,7,30,254,30,7,0,0,0,64,48,60,31,30,12,4,16,16,16,56,56,124,124,68
 9030 DATA0,2,12,60,248,120,48,16,0,224,120,127,120,224,0,0,16,48,120,248,60,12
 9040 DATA2,0,68,124,124,56,56,16,16,0,12,30,31,60,48,64,0,0,0,8,0,0,0,0,0,0
 9050 DATA0,0,0,64,0,0,0,0,0,0,6,6,0,0,0
```

Astrogladiator listing

Island of zombies

Alan Fyfe,
Edinburgh.

DRAGON

THIS PROGRAM is a Dragon version of the popular game where a target is followed by blind zombies. In this version, the target — a black diamond — moves on directional orders from the keyboard. On each move the zombies, represented by yellow squares, converge on the target. The aim is to lure them all into the pits — black squares — dotted all over the island. The game is one of strategy rather than speed.

Lines 60 to 130 set up the island with a random number — 21 to 30 — of black pits. The RND function does not generate true random numbers and a useful dodge to prevent the same pattern occurring on each "first" game is found in line 2150. The computer generates needless random numbers while waiting for a response to line 2130. Lines 2120 and 2140 mean that this routine is missed on all but the first game.

Lines 200 to 370 set up a random number — 12 to 16 — of zombies and a random position for the target. Lines 280 to 290 check that there are no zombies immediately adjacent to the target at the start of the game.

Lines 500 to 680 read the direction and, using the Instr function, move the target. If a string other than a direction is input then the program passes to line 2500. If the target moves into the sea, a pit or a zombie, the game ends.

Lines 700 to 990 move the zombies. The X and Y co-ordinates of the target are compared with the position of each zombie in turn. If both differ, the zombie moves diagonally towards the target. If one set of co-ordinates is the same, the zombie position merely increments along that co-ordinate. This is taken care of in line 770 to 780 and associated subroutines. Lines 800 to 820 check to see whether the zombie is walking into a pit, another zombie or the target. If so then appropriate action is taken in lines 910 and after.

Line 70 accelerates the action of the program by engaging the dual-rate of the microprocessor. If the game is finished through program control, line 1510 switches off the dual rate. If the game is finished by the Break key, the reset button will have to be pressed before saving or loading another program.

```
 10 'ISLAND OF ZOMBIES'
 20 'BY ALAN FYFE - MARCH 1983'
 30 DIM N(384),XZ(16),YZ(16)
 58 '
 59 'SETTING UP ISLAND'
 60 CLS4:GOSUB2000
 70 POKE&HFFD7,0
 80 FOR I=33TO350:N(I)=143:NEXTI
 90 FOR I=0TO32:N(I)=175:NEXTI
 100 FOR I=63TO351STEP32:N(I)=175:N(I+1)=175:NEXTI
 110 FOR I=353TO383:N(I)=175:NEXTI
 120 R=RND(10)+20
 130 FOR J=1TOR:P=RND(10):D=RND(30):N(P*32+D)=128:NE
XTJ
 190 '
 199 'ZOMBIES AND TARGET'
 200 S=RND(5)+11:Z=S
 210 FOR K=1TOS
 220 P=RND(10):Q=RND(30)
 230 IF N(P*32+Q)=128 THEN 220
 240 XZ(K)=Q:YZ(K)=P
 250 N(P*32+Q)=159:NEXTK
 260 P=RND(8):Q=RND(28):U=(P+1)*32+Q+1
 270 IF N(U)<>143 THEN 260
 280 FOR I=1TO3:FOR J=0TO64STEP32
 290 IF N(U-34+I+J)=159 THEN260
 300 NEXT J,I
 310 XT=Q+1:YT=P+1
 320 N(U)=42
 330 SOUND200,5:PRINT@482,"   PRESS space TO BEGIN
  ";:SOUND200,5
 340 I$=INKEY$:IF I$="" THEN 340
 350 CLS3
 360 FOR K=0TO383:PRINT@K,CHR$(N(K));:NEXTK
 370 GOSUB1500
 498 '
 499 'MOVING TARGET'
 500 PRINT@417,"THERE ARE";Z;"ZOMBIES AFTER YOU";
 510 IF Z=0 THEN1210
 520 PRINT@449,"WHICH WAY";:INPUT W$
 530 XS=XT:YS=YT
 540 IF INSTR(1,W$,"N")>0 THEN YS=YT-1
 550 IF INSTR(1,W$,"S")>0 THEN YS=YT+1
 560 IF INSTR(1,W$,"W")>0 THEN XS=XT-1
 570 IF INSTR(1,W$,"E")>0 THEN XS=XT+1
 580 IF XS=XT AND YS=YT THEN GO TO 2500
 590 V=YS*32+XS
 600 PRINT@(YT*32+XT),CHR$(143);
 610 N(YT*32+XT)=143
 620 GOSUB1500
 630 IF N(V)=175 THEN 1000
 640 IF N(V)=128 THEN 1040
 650 IF N(V)=159 THEN 1080
 660 YT=YS:XT=XS
 670 PRINT@V,CHR$(42);
 680 N(V)=42
 699 '
 700 'MOVING ZOMBIES'
 710 PRINT@417,"LOOK OUT! HERE COME THE ZOMBIES";:PR
INT@449,"THERE ARE";Z;"OF THEM";
 720 FOR I=1TOS:XU=XZ(I):YU=YZ(I):U=YU*32+XU
 730 IF XU=999 THEN980
 740 FOR L=1TO3
 750 PRINT@U,CHR$(143);:FOR L2=1TO25:NEXTL2
 760 PRINT@U,CHR$(159);:FOR L2=1TO25:NEXTL2,L1
 770 ON SGN(XU-XT)+2 GOSUB850,860,870
 780 ON SGN(YU-YT)+2 GOSUB880,890,900
 790 PRINT@U,CHR$(143);:N(U)=143:V=YU*32+XU
 800 IF N(V)=128 THEN 910
 810 IF N(V)=159 THEN 940
 820 IF N(V)=42 THEN 1240
 830 XZ(I)=XU:YZ(I)=YU:PRINT@V,CHR$(159);:N(V)=159
 840 PLAY"T20L0C":GOTO 980
 850 XU=XU+1:RETURN
 860 RETURN
 870 XU=XU-1:RETURN
 880 YU=YU+1:RETURN
 890 RETURN
 900 YU=YU-1:RETURN
 910 PRINT@416,STRING$(64,191);:PRINT@417,"THERE GOE
S A ZOMBIE DOWN A HOLE";
 920 PLAY"T150O5GCD#GCD3GC02GCD1GT50ECECECECECECECEC
ECECECETSC"
 930 Z=Z-1:XZ(I)=999:GOTO 970
 940 PRINT@416,STRING$(64,191);:PRINT@417,"ONE ZOMBI
E SQUASHED ANOTHER";
 950 PLAY"O1T2CP50CP50C"
 960 Z=Z-1:XZ(I)=999:IF Z=0 THEN 1210
 970 PRINT@449,"THERE ARE";Z;"ZOMBIES LEFT";
 980 NEXT I
 990 GOTO 370
 998 '
 999 'MISHAPS TO TARGET'
 1000 PRINT@417,"YOU FELL IN THE SEA AND DROWNED";
 1010 PLAY"T40O5"
 1020 FOR D=1TO4:PLAY"BA&FEDCD-":NEXT D:PLAY"BA&FEDC
"
 1030 GOTO1200
 1040 PRINT@417,"YOU STEPPED IN A BOTTOMLESS PIT";
 1050 PLAY"T40SFEO4FEO3FEO2FEO1FTS0"
 1060 FOR D=1TO25:PLAY"EC":NEXT D
 1070 GOTO 1200
 1080 PRINT@417,"YOU WALKED INTO A ZOMBIE,IDIOT";
 1090 FOR D=1TO8:PLAY"T16O1GF&FE":NEXT D
 1198 '
 1199 'END OF GAME'
 1200 PRINT@449,"ANOTHER GO";:INPUT A$:IF LEFT$(A$,1
```

(continued on page 170)

wildings

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(continued from page 168)

```
)="Y" THEN&0 ELSE 1510
1210 GOSUB1500
1220 PRINT@417,"CONGRATULATIONS- YOU SURVIVED!";
1230 GOTO1200
1240 GOSUB1500
1250 PRINT@W,CHR$(191);
1260 PRINT@417,"YOU WERE CAUGHT BY A ZOMBIE";
1270 GOTO 1090
1498 '
1499 'DELETE PREVIOUS TEXT'
1500 PRINT@416,STRING$(64,191);:RETURN
1510 POKE&HFFD6,0:END
1998 '
1999 'INTRODUCTION'
2000 PRINT@334,"YOU ARE MAROONED ON A DESERT";
2010 PRINT@66,"ISLAND WHICH IS COVERED WITH";
2020 PRINT@98,"BOTTOMLESS PITS AND INFESTED";
2030 PRINT@130,"WITH ZOMBIES. THESE HORRIBLE";
2040 PRINT@162,"CREATURES CANNOT SEE BUT CAN";
2050 PRINT@194,"NEAR VERY WELL WHEN YOU MOVE";
2060 PRINT@226,"AROUND. THE TRICK IS TO LURE";
2070 PRINT@258,"THEM INTO THE PITS.          ";
2080 PRINT@322,"ENTER EACH MOVE AS A COMPASS";
2090 PRINT@354,"DIRECTION (N,SW,ETC).      ";
2100 PRINT@418,"  =YOU      =ZOMBIE     =PIT ";
2110 PRINT@419,CHR$(42);:PRINT@428,CHR$(159);:PRINT
@440,CHR$(128);
2120 IF KEY=1 THEN 2170
2130 SOUND100,5:PRINT@482,"PRESS space TO SET UP IS
LAND";:SOUND100,5
2140 KEY=1
2150 I$=INKEY$:I=RND(10):IF I$=""THEN 2150
2160 PRINT@482,STRING$(28,191);
2170 RETURN
2498 '
2499 'NON-DIRECTION KEY PRESSED'
2500 GOSUB1500
2510 PRINT@417,"SORRY- YOU MAY NOT JUST JUMP UP";
2520 PRINT@449,"AND DOWN ON THE SPOT!";
2530 FOR F4=1TO2000:NEXT F4
2540 GOTO 370
```

Kong jump

Graham Fitter,
Hassocks,
West Sussex.

ZX-81

IN THIS GAME, for the 16K ZX-81 the player has to move his man along a black wall, jumping over the holes, and jumping over the barrels that Kong is throwing at you. A point is given for jumping a set of barrels, and 25 points are given for jumping on the home at the end of the course, which changes when you jump on to the home.

Use keys 5 and 8 to move the man left and right. These keys shifted will jump the man in those directions, and Shifted 7 will push the man upwards.

```
  70 CLS
  80 GOSUB 430
  90 LET O=1
 100 LET A=1
 110 LET B=A
 120 LET C=26
 130 LET S=0
 140 LET K=C
 150 LET L=A
 160 LET N=L+L
 170 LET P=C
 180 LET T=L-L
 190 PRINT AT PI,T;A$(Q);TAB 27;
" ";TAB T;"
[illegible]
[illegible]
TAB 27;"  "
 200 PRINT AT N,K;"H";AT N,C;"OO
O ";AT A,B;"O";TAB B;"L" AND INK
EY$="6";TAB B;"L" AND INKEY$=CHR
$ 115;TAB B;"L" AND INKEY$="";TA
B B;"J" AND INKEY$="5";TAB B;"J"
 AND INKEY$=CHR$ 114;TAB B;"X" A
ND INKEY$=CHR$ 112;AT A+N,B;
 210 LET E=PEEK (PEEK 16398+256*
PEEK 16399)
 220 IF A=L AND B=C OR A=L AND B
=C+N OR A=L AND B=C+N+N OR A>=N
THEN GOTO 360
 230 IF E<>128 THEN LET A=A+L
 240 LET S=S+(E=P+P)+P*(E=45)
 250 IF E=45 THEN GOTO 320
 260 LET C=C-1
 270 IF C=T THEN LET C=P
 280 LET B=B+(INKEY$="8" OR INKE
Y$=CHR$ 115)-(INKEY$="5" OR INKE
Y$=CHR$ 114)
 290 IF E=128 AND INKEY$>=CHR$ 1
12 THEN LET A=A-L
 300 PRINT AT N,T;"      ";AT T,B
-L;"    ";TAB B-L;"    ";TAB B-L;"
"
 310 GOTO 200
 320 LET K=K+((P-L)*(K=L))-((P-L
)*(K=P))
 330 LET O=O+1
 340 IF O>10 THEN LET O=1
 350 GOTO 190
 360 PRINT AT 5,0;"[illegible]";S
 370 PRINT AT 7,4;"GAME OVER"
 380 PRINT AT 8,2;"PRESS ANY KEY
 TO START"
 390 IF INKEY$<>"" THEN GOTO 395
 391 PRINT AT 2,27;"      ";TAB 27
;"  ";TAB 27;"  ";TAB 27;"
  ";TAB 27;"  ";TAB 27;"
  ";TAB 27;"  O "
 392 IF INKEY$<>"" THEN GOTO 395
 393 PRINT AT 2,27;"  ";TAB 27
;"  ";TAB 27;"  ";TAB 27;"
  ";TAB 27;"  ";TAB 27;"
  "
 394 GOTO 390
 395 FOR A=0 TO 20
 396 PRINT AT A,27;"  O ";AT A-
1,27;"  "
 397 NEXT A
 398 PRINT AT 13,28;"  ";AT 19,2
9;"  "
 399 FOR A=0 TO 50
 400 NEXT A
 410 CLS
 420 RUN
 430 DIM A$(10,27)
 440 LET A$(1)="[illegible]"
 450 LET A$(2)="[illegible]"
 460 LET A$(3)="[illegible]"
 470 LET A$(4)="[illegible]"
 480 LET A$(5)="[illegible]"
 490 LET A$(6)="[illegible]"
 500 LET A$(7)="[illegible]"
 510 LET A$(8)="[illegible]"
 520 LET A$(9)="[illegible]"
 530 LET A$(10)="[illegible]"
 540 RETURN
 550 SAVE "KON[illegible]"
 560 RUN
```

Time clock

A S P Heald,
Leeds.

DRAGON

I FOUND a decent clock program for the Dragon 32 computer was necessary due to the inadequacy of the Dragon's timer function. This function is reset to zero every 21.8 minutes, making it impractical for use as an ordinary clock. It is only really useful as a simple timer: as its name suggests.

The actual clock program is written in machine code. It is driven by the Dragon's analogue timer, which is linked directly to the 6809's IRQ interrupt pin. This timer causes an interrupt every 0.02 seconds.

The clock routine is entered when the IRQ is triggered. Then it increments the time by a 0.02 seconds. The time is stored in a four-byte table. Each byte contains hours, minutes, seconds, 0.02 seconds, respectively.

The clock program consists of the interrupt-handling routine, a routine to start the clock and one to stop it. In order to set the time the stop routine should be called, then the required time Poked into the time-table, then the Start routine should be called. To read the clock the time-table should be Peeked.

The Basic program entitled Clock Loader will put the machine code into memory ready for use. The routine can be located anywhere in memory, being written in entirely relocatable code, and so the loader first asks where the user wishes it to be positioned.

A good place to put the code is in the first graphics page, so long as it is not used for graphics, of course, in which case the user should enter 1536 as the start address. The machine code will then be put into memory at the specified point. Following this the loader displays the entry points for the start and stop routines, and the locations of the time table bytes. These should be noted for future use. After this the Basic program can be deleted from memory.

(continued on page 179)

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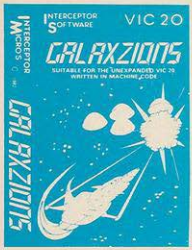

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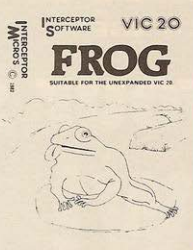

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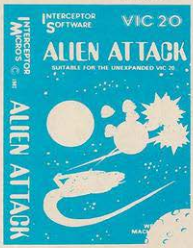

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Kong has stolen Mario's girlfriend and taken her to the top of his steel fortress. You must guide Mario first across the 'Easy Elevator' and over the custard pies onto the fortress. Up the ladders to your loved one, however, be careful not to be killed in the process by the barrels which Kong hurls down the structure. Includes some of the best graphics ever seen on the VIC 20

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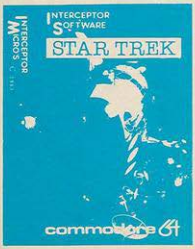

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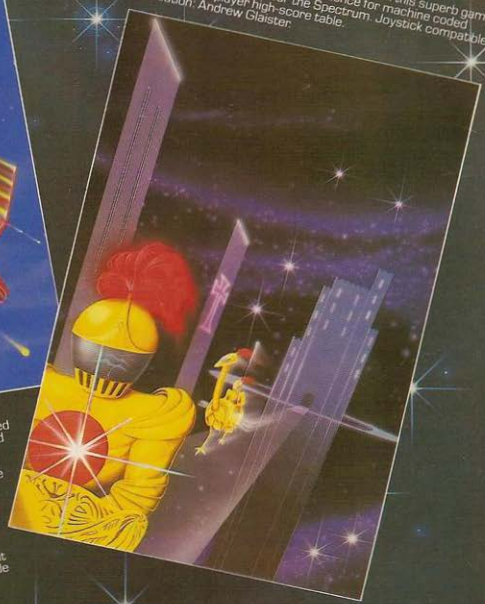
Realisation: Andrew Glaister.



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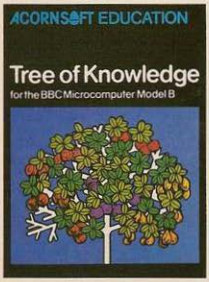
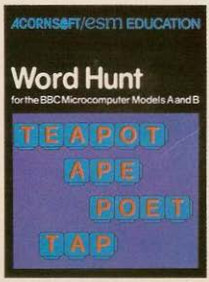
Not surprisingly, it's made by Acornsoft, the software division of Acorn Computers Ltd., who designed and built the BBC Microcomputer. So naturally you can expect the highest quality software with the built-in ingenuity to fully exploit the BBC Micro's potential.

Further education for everyone.

Tree of Knowledge (£9.95) is an interactive program for children of all ages teaching categorisation. It illustrates some of the more practical aspects of computing in that the pupil first educates the computer, building up a database by answering the computer's questions, and the database is then used to play games of deduction and logic.

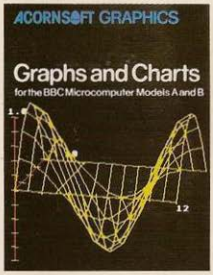
Word Hunt (£11.90) is a set of four programs, each containing a list of nine words. The object of the exercise is to select one word and then try to create as many smaller words as possible from the selected word.

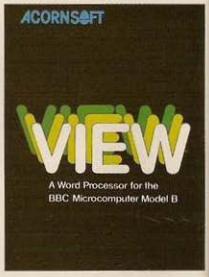




Increase your business acumen.

Graphs and Charts (price £17.45) which includes the book 'Graphs and Charts on the BBC Microcomputer' contains a set of programs



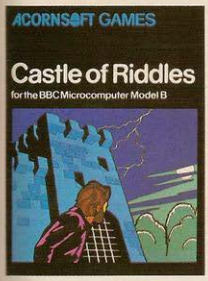


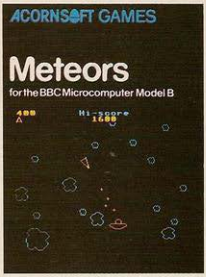
to present data graphically in a wide range of applications. The graphs include automatic scaling, labelling of axes and use of colours.

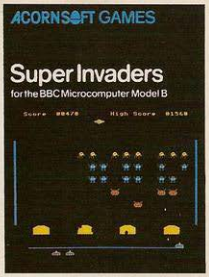
And VIEW (price £59.80) a program that enables your machine, together with a printer, to operate as a fully operational word processor. For convenience the program is in ROM so that it can become a permanent feature of your machine. (It can easily be fitted by your local dealer). You'll find out more by going to your dealer or by sending for the free catalogue.

Mind-boggling games.

Castle of Riddles (price £9.95) is a magical adventure, with wizardry and hocus pocus of all kinds; booby traps and fiendish riddles to be unravelled along the tortuous route to the Magic Ring of Power. Your reward is to keep the







treasure you find along the way.

Meteors (price £9.95) is a game where you have to manoeuvre your laser-ship through a hail of meteors, smashing them with your laser bolts as they hurtle towards you on all sides. Complete with sound effects and table of Hi-Scores.

Super Invaders (price £9.95) is a fight against invading aliens. The only way to resist and avoid subsequent annihilation is to destroy the aliens before they land. You have three mobile launchers whose hyper-velocity missiles will instantly vaporise their target on impact. This game includes high-score, and is fully compatible with either keyboard or joysticks.

Understanding computers.

Peeko-Computer (price £9.95) simulates the operation of a simplified microcomputer in order to teach the fundamentals of machine-code programming. It comes complete with a 16 page instruction manual including exercises and examples, and the cassette features five demonstration Peeko-Computer programs.

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If you're a credit card holder and would like to buy cassettes of the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

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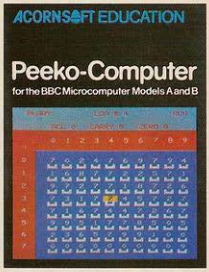

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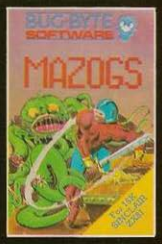

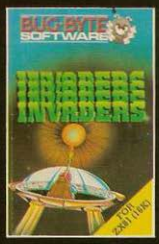

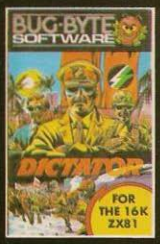

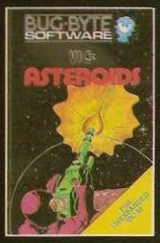

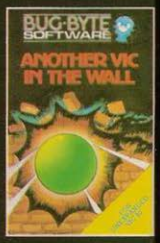

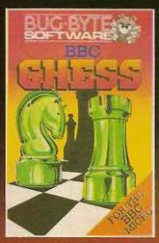

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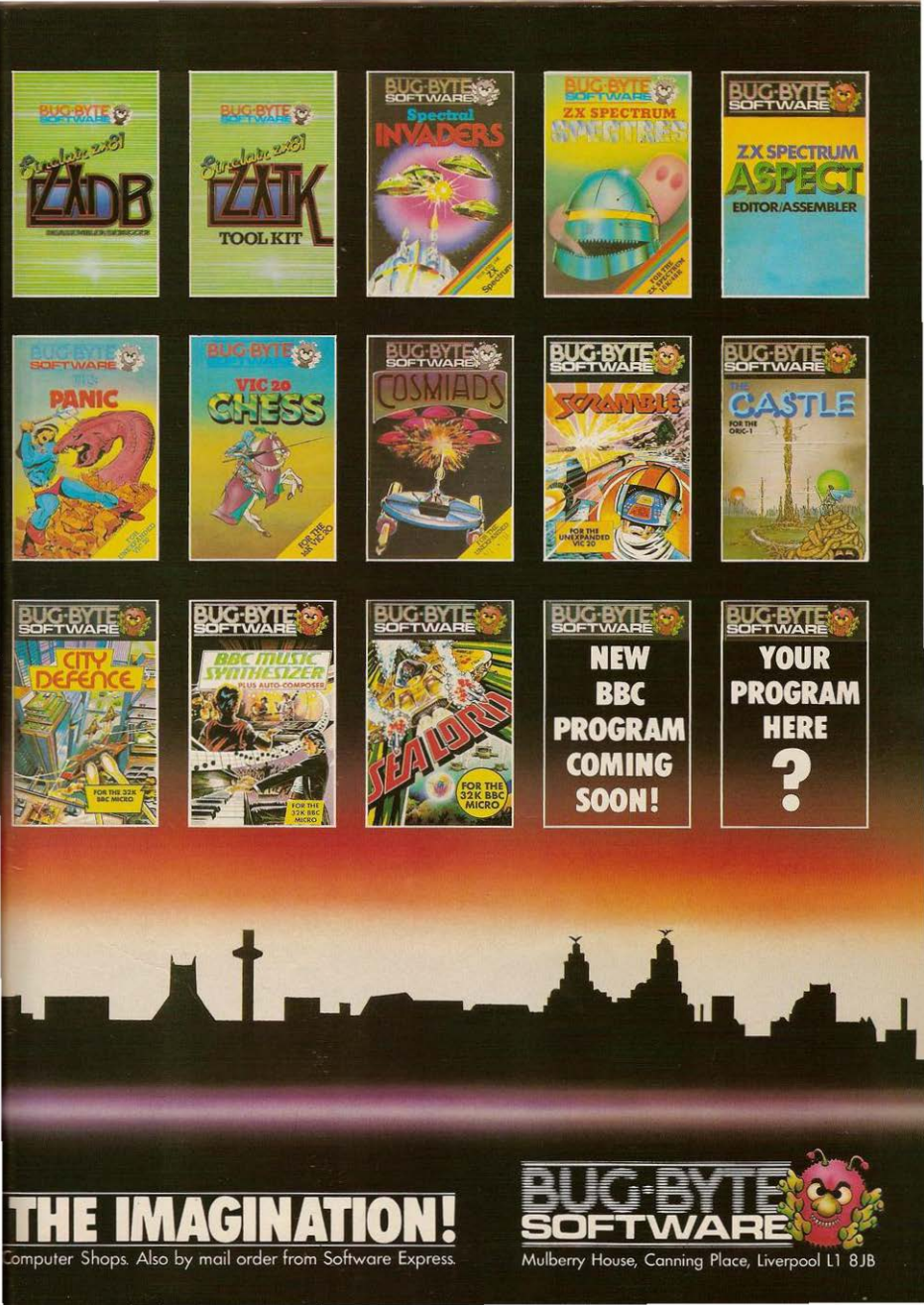
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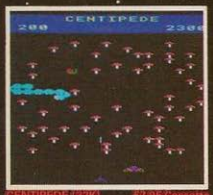

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(continued from page 170)

Once the machine code has been put into memory it can be saved using

CSAVEM "CLOCK", S, S+84,S

where S is the start address of the routine. The second Basic program, entitled Clock Demonstration, is a short demonstration of the use of the clock. This program also requires the user to enter the start address of the machine code. The user must then enter the time in hours and minutes as on the 24-hour clock.

Line 170 sets up pointers to the hours, minutes, and seconds registers in the time table.

Line 180 sets the time: here the clock-start routine automatically sets the seconds and 0.02 seconds registers to zero, and does the same with hours and minutes if they are not in the range 0 to 23, or 0 to 59, respectively. Line 200 displays the time on the screen, which is continually updated.

```
100 CLS:PRINT "CLOCK LOADER"
110 PRINT "(C) 1983 BY A.S.P.HEALD":PRINT
120 INPUT "START ADDRESS";S
130 FOR A=S TO S+84
140 READ H$:POKE A,VAL("&H"+H$)
150 NEXT A
160 PRINT:PRINT "USE EXEC";S;"TO START CLOCK"
170 PRINT "USE EXEC";S+30;"TO STOP IT"
180 PRINT:PRINT "DATA LOCATIONS:"
190 PRINT "HOURS AT";S+81
200 PRINT "MINS AT";S+82
210 PRINT "SECS AT";S+83
220 PRINT "1/50 SECS AT";S+84
230 PRINT
240 DATA 30,CC,51,6F,84,6F,82,86
250 DATA 3B,A1,82,24,02,6F,84,86
260 DATA 17,A1,82,24,02,6F,84,30
270 DATA CC,0B,BF,01,0D,39,8E,9D
280 DATA 3D,BF,01,0D,39,30,CC,2C
290 DATA 6C,84,86,32,A1,84,26,1E
300 DATA 6F,84,6C,82,86,3C,A1,84
310 DATA 26,14,6F,84,6C,82,A1,84
320 DATA 26,0C,6F,84,6C,82,86,18
330 DATA A1,84,26,02,6F,84,7E,9D
340 DATA 3D,00,00,00,00
```

```
100 CLS:PRINT "CLOCK DEMONSTRATION"
110 PRINT "(C) 1983 BY A.S.P.HEALD"
120 PRINT
130 INPUT "START OF CLOCK ROUTINE";SR
140 PRINT
150 INPUT "TIME: HOURS";TH
160 INPUT "       MINS ";TM
170 H=SR+81:M=SR+82:S=SR+83
180 EXEC SR+30:POKE H,TH:POKE M,TM: EXEC SR
190 CLS:PRINT@195,"TIME:"
200 PRINT@200,PEEK(H);PEEK(M);PEEK(S)
210 GOTO 200
```

Snakman

R S Burdon,
Lichfield,
Staffordshire.

SPECTRUM

SNAKMAN for the 16K Spectrum involves manoeuvring a snake, using the cursor keys, around the maze. The object of the game is to consume as many eggs as you can without crashing into the sides of the maze. Your snake increases by one segment every time four eggs are eaten. Biting your tail is fatal and so is doubling back on to yourself. Bonus cherries appear in the middle of the maze and these have to be quickly consumed before they disappear.

The program includes the top three high scores and an arcade-style way of entering your name, operated by left, right and up cursor keys. Three jingles are played at different parts of the program and the score high-scorer and lives are visible at all times.

```
   1 REM SNAKMAN © MCMLXXXIII
   2 REM   By Richard Burdon
   3 GO SUB 9000: LET h$="SNAKMAN": LET i$="SNAKMAN": LET j$="SNAKMAN": LET hi=500: LET h2=500: LET h3=500
   5 LET no=0: LET lives=3: LET s=0: LET d=0
  10 BORDER 7: PAPER 7: CLS : INK 0: GO SUB 4000: INK 2: GO SUB 1000: INK 1
  11 PRINT AT 0,11;"SCORE"
  12 PRINT AT 0,22;"LIVES "
  15 PRINT AT 0,0;h$
  20 LET y$=CHR$ 10+CHR$ 10
  21 LET x$=CHR$ 15+CHR$ 16
  40 LET a$="●"
  45 FOR z=1 TO lives: PRINT AT 0,(27+z);"●": NEXT z
  60 LET l=2
  70 LET d=0
 200 LET x=CODE x$
 205 IF d>=376 THEN GO TO 10
 210 IF INKEY$="8" THEN LET x=x+1: LET a$="●"
 212 IF INKEY$="5" THEN LET x=x-1: LET a$="●"
 220 LET y=CODE y$
 230 IF INKEY$="7" THEN LET y=y-1: LET a$="●"
 232 IF INKEY$="6" THEN LET y=y+1: LET a$="●"
 250 IF x=CODE x$ AND y=CODE y$ THEN LET x=x+x-CODE x$(2): LET y=y+y-CODE y$(2)
 260 IF ATTR (y,x)=58 OR ATTR (y,x)=41 THEN GO SUB 3500
 262 IF ATTR (y,x)=34 THEN LET s=s+1: LET d=d+1: LET l=l+.25: BEEP .01,1
 264 IF ATTR (y,x)=57 THEN GO SUB 3500
 270 IF ATTR (y,x)=43 THEN PRINT AT 0,0; FLASH 1;"BONUS 20!"; FLASH 0: GO SUB 6110: LET s=s+20: LET no=150: PRINT AT 0,0;"         ";AT 0,0;h$
 290 PRINT AT 0,17;s
 295 PRINT PAPER 5;AT CODE y$(1),CODE x$(1);"●"
 300 PRINT PAPER 5;AT y,x;a$
 400 PRINT PAPER 5; INK 5;AT CODE y$(l),CODE x$(l);" "
 500 LET x$=CHR$ x+x$( TO l)
 510 LET y$=CHR$ y+y$( TO l)
 600 LET no=no+1
 610 IF no>100 THEN PRINT INK 3; PAPER 5;AT 10,15;"◆◆"
 620 IF no>150 THEN PRINT INK 5; PAPER 5;AT 10,15;"  ": LET no=0
 999 GO TO 200
1000 FOR n=0 TO 20: NEXT n
1010 FOR n=2 TO 20: PRINT PAPER 4;AT n,1;"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓": BEEP .02,n: NEXT n
1015 FOR n=7 TO 12: PRINT PAPER 5;AT n,6;"                    ": BEEP .02,n: NEXT n
1020 FOR n=20 TO 1 STEP -1: PRINT AT n,0;"█";AT n,31;"█": BEEP .01,n: NEXT n
1025 PRINT AT 1,0;"████████████████████████████████";AT 21,0;"████████████████████████████████"
1030 PRINT AT 4,3;"███████████";AT 4,14;"███";AT 4,20;"███████████"
1040 PRINT AT 7,3;"█";AT 7,6;"█████████";AT 7,17;"█████████";AT 7,28;"█"
1050 PRINT AT 8,3;"█";AT 8,6;"█";AT 8,25;"█";AT 8,28;"█"
1060 PRINT AT 11,3;"█";AT 11,6;"█";AT 11,25;"█";AT 11,28;"█"
1070 PRINT AT 12,3;"█";AT 12,6;"█████████";AT 12,17;"█████████";AT 12,28;"█"
1080 PRINT AT 15,3;"███████████";AT 15,17;"███████████"
1090 PRINT AT 18,3;"██";AT 18,7;"████████";AT 18,17;"█████████";AT 18,27;"██"
```

(continued on page 181)

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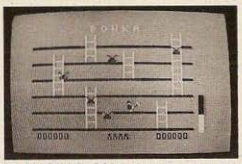

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Bridge Software

(continued from page 179)

```
1999 RETURN
3000 PRINT AT 10,11; FLASH 1; BR
IGHT 1;"GAME  OVER"
3005 PRINT AT 0,27;"  "
3010 FOR n=0 TO 500: NEXT n
3050 IF s>h3 THEN GO SUB 5000
3100 CLS : GO SUB 5611
3500 LET lives=lives-1
3510 FOR n=40 TO 10 STEP -3: BEE
P .2,n: NEXT n
3515 IF lives=0 THEN GO TO 3000
3520 INK 2: GO SUB 1000: INK 1
3530 PRINT AT 0,28;"    ": GO TO
11
4000 CLS : PRINT AT 10,7;"* S N
A K M A N *";AT 12,11;"
"
4005 RESTORE 4100
4010 FOR n=1 TO 13: READ a,b: BE
EP a,b: NEXT n
4050 RETURN
4100 DATA .3,1,.1,1,.3,1,.1,1,.1
,1,.2,3,.4,4,.2,3,.1,3,.1,3,.1,3
,.2,4,.3,6
5000 BORDER 3: PAPER 5: INK 0: L
ET y=6: LET x=0: CLS : PRINT AT
12,10;"HIGH  SCORE"
5001 PRINT AT 5,0;"A B C D E F G
 H I J K L M N O P";AT 7,0;"Q R
S T U V W X Y Z * # ( ) ! .";AT
9,0;"£ : & = + - / \ ? $ < > ©
 END"
5002 LET n$=""
5003 LET r$=" "
5005 PRINT AT 15,1;"
* *  SNAKMAN  * *
 *             *
* *            * *"
5010 PRINT AT y,x;"♥"
5015 LET a=y: LET b=x
5020 LET x=x+2*(INKEY$="8")-2*(I
NKEY$="5")
5021 IF x<0 AND y=6 THEN LET X=0
5022 IF x>30 AND y=6 THEN LET x=
0: LET y=y+2
5023 IF x>30 AND y=8 THEN LET x=
0: LET y=y+2
5025 IF x<0 AND y=8 THEN LET x=3
0: LET y=y-2
5026 IF x<0 AND y=10 THEN LET x=
30: LET y=y-2
5028 IF y=10 AND x>=28 THEN GO T
O 5201
5030 IF INKEY$="7" AND LEN n$<10
 THEN LET a$=SCREEN$ (y-1,x): LE
T n$=n$+a$: FOR n=30 TO 0 STEP -
3: BEEP .01,n: NEXT n
5040 PRINT AT 0,10;n$
5050 PAUSE 5
5190 PRINT AT a,b;" "
5200 GO TO 5010
5300 IF s>hi THEN LET h3=h2: LET
 h2=hi: LET hi=s: LET j$=i$: LET
 i$=h$: LET h$=n$: GO TO 5400
5310 IF s>h2 THEN LET h3=h2: LET
 h2=s: LET j$=i$: LET i$=n$: GO
TO 5400
5320 IF s>h3 THEN LET h3=s: LET
j$=n$: GO TO 5400
5500 CLS : PRINT INK 2;AT 10,0;"
 1    ";hi;AT 10,15;h$
5505 PRINT INK 1;AT 12,0;" 2
";h2;AT 12,15;i$
5510 PRINT INK 1;AT 14,0;" 3
";h3;AT 14,15;j$
5520 PAPER 5: PRINT INK 0;AT 5,1
0;"SCORE TABLE";AT 7,0;"RANK";AT
 7,5;"SCORE";AT 7,15;"NAME"
5550 FOR n=0 TO 100: NEXT n
5600 PRINT AT 21,5;"press any ke
y to play !"
5605 FOR n=1 TO 200
5610 IF IN 65278<>255 OR IN 3276
6<>255 OR INKEY$<>"" THEN GO TO
5612
5611 NEXT n: CLS : PRINT AT 10,1
0;"S N A K M A N";AT 12,16;"BY";
AT 14,9;"BURDON COMPUTERS";AT 16
,14;"© 1983": GO SUB 6000: GO TO
 5500
5650 GO TO 5
6010 RESTORE 6050
6020 FOR n=1 TO 20
6030 READ a,b: BEEP a,b: NEXT n
6050 DATA .2,0,.1,5,.1,5,.2,0,.2
,5
6055 DATA .2,1,.1,6,.1,6,.2,1,.2
,5
6060 DATA .2,0,.1,5,.1,5,.2,0,.2
,5
6065 DATA .1,1,.1,2,.1,3,.1,4,.1
,5
6100 RETURN
6110 RESTORE 6150: FOR n=1 TO 12
6120 READ a: BEEP .2,a: NEXT n
6130 RETURN
6150 DATA 0,0,4,12,11,9,-1,-1,2,
11,9,7
9000 RESTORE 9500: FOR z=1 TO 7
9005 READ z$
9010 FOR n=0 TO 7: READ a: POKE
USR z$+n,a: NEXT n
9020 NEXT z
9100 RETURN
9500 DATA "a",60,126,255,255,255
,255,126,60
9510 DATA "b",0,24,60,60,60,60,2
4,0
9520 DATA "e",14,55,245,240,245,
254,126,28
9530 DATA "c",112,236,31,15,31,2
55,124,56
9540 DATA "f",24,60,126,255,245,
227,98,34
9550 DATA "d",68,70,199,175,255,
126,60,24
9560 DATA "g",0,4,8,60,126,126,6
0,24
```

Life

Andrew Dilley,
Witley,
Surrey.

VIC-20

THIS LIFE program is fast, uses nearly all the screen, makes good use of colour graphics, and has a bit of sound thrown in.

The emphasis is definitely on fast, as the main fascination of Life is the constantly changing patterns. Since Basic is far too slow to do this, I have used some machine-code to control the birth-death logic and to display the cells. Unfortunately, because of the way screen memory moves about in the Vic when more than 3K of extra RAM is fitted, those lucky Vic owners will need to down-grade their machines to use the machine code.

The machine code is really quite straightforward. It looks at each character space in the display in turn. It then counts up how many "live" cells surround the space it is currently examining, and, depending on the rules of Life, it marks that space as either live or dead. It does this by changing that space's colour.

When it has done this for the whole display, it goes through it again. This time, wherever it finds the colour that corresponds to a live cell, it puts in a cell character. Otherwise, it puts in a space.

Because the program uses colour to distinguish between live and dying cells, some really interesting effects can be obtained depending on the choice of colours. To allow as much freedom as possible I have included multi-colour mode colours, which can be used for the dying cell colour. The colours used in the multi-colour graphics depend to some extent on the colour selected for the live cells.

The initial pattern of cells can either be randomly produced by the computer, or set by the user, using either the keyboard or a joystick.

When the colony of cells either becomes stable or dies the program will tell you how many generations of cells it took, and allow you to either rerun the program or end.

```
10 TC=7680:CO=30720
20 KB=197:PA=37137:PB=37152:DD=37154
30 POKE37139,0
100 GOSUB1000
110 GOSUB2000
120 G=0:N=128:D=2:PRINT" HIT 'F1' TO STOP  "
130 POKE36876,N:SYS828:POKE36876,0
140 N=N+D:IFN=128ORN=252THEND=-D
150 IFPEEK(0)>0THEN200
160 IFPEEK(KB)=39THEN210
170 G=G+1:GOTO130
197 REM--------------
198 REM    END
199 REM--------------
200 PRINT"STOPPED AFTER"G"GOS"CHR$(157)CHR$(148)"E";
210 PRINT"RE-RUN OR END ?  "
220 GOSUB3000
230 IFA$="R"THEN110
240 IFA$<>"E"THEN220
250 POKE36879,27:PRINT"HOPE YOU ENJOYED IT":END
997 REM--------------
998 REM   TITLE
999 REM--------------
1000 POKE36879,44
1010 PRINT""TAB(7)"L I F E":PRINTTAB(6)"---------"
1020 PRINT"  A VERSION OF THE     CLASSIC COMPUTER GAME     BY ANDREW DIL
LEY"
1030 PRINT" LOADING MACHINE CODE":PRINTTAB(5)"PLEASE WAIT"
1040 GOSUB5000
1050 PRINT"     R E A D Y     "
1060 PRINT" HIT ANY KEY TO START"
1070 GOSUB3000:RETURN
1497 REM-------------
1498 REM INSTRUCTIONS
1499 REM-------------
1500 PRINT"  USE THESE KEYS TO     POSITION THE CELLS"
1510 PRINTTAB(10)"UP I S":PRINTTAB(4)"LEFT-K >-RIGHT":PRINTTAB(10)"
Xldown"
1520 PRINT" SPACE-BAR FOR CELL"
1530 PRINT"(OR USE A JOY-STICK)"
1540 PRINT"     HIT ANY KEY "
1550 GOSUB3000:RETURN
1997 REM-------------
1998 REM  START
1999 REM-------------
2000 PRINT"":FORI=0TO7:POKE646,I:PRINT" ●";:NEXT:PRINT
2010 PRINT"LIVE CELL COLOUR"
2020 INPUT"(1-8)";LC:IFLC<1ORLC>8THENPRINT"":GOTO2020
2030 LC=LC-1:POKE36878,15OR16*LC:POKE646,LC:PRINTTAB(11)"●"
2040 FORI=0TO15:POKE646,I:PRINT" ●";:NEXT:PRINT
2050 PRINT"'DYING' CELL COLOUR"
2060 INPUT"(1-16)";DC:IFDC<1ORDC>16ORDC-1=LCTHENPRINT"":GOTO2060
2065 DC=DC-1:POKE646,DC:PRINTTAB(11)"●"
2070 PRINT"OK (Y/N)?":GOSUB3000
2080 IFA$<>"Y"THEN2000
2090 POKE871,LC:POKE903,LC:POKE867,DC
2100 PRINT"POSITION CELLS":PRINTTAB(5)"OR":PRINT"RANDOM ?"
2110 GOSUB3000
2120 IFA$="P"THENGOSUB2500:RETURN
2130 IFA$="R"THENGOSUB2800:RETURN
2140 GOTO2110
2497 REM-------------
2498 REM  POSITION
2499 REM-------------
2500 PRINT" INSTRUCTIONS (Y/N)?":GOSUB3000
2510 IFA$="Y"THENGOSUB1500
2520 PRINT" 'F7' WHEN FINISHED":POKE198,0:X=1:Y=1
2530 P=TC+22*Y+X:U=PEEK(P):UC=PEEK(CO+P)
2535 POKEP,128+U:POKECO+P,1
2540 K=PEEK(KB):J1=PEEK(PA):POKEDD,127:J2=PEEK(PB):POKEDD,255
2550 IFK=63THENPOKEP,U:POKECO+P,UC:RETURN
2560 IFK=32OR(J1AND32)=0THENU=81:UC=LC:GOTO2535
2570 NX=X+(K=29OR(J1AND16)=0)-(K=37OR(J2AND128)=0)
2580 NY=Y+(K=41OR(J1AND4)=0)-(K=26OR(J1AND8)=0)
2590 IFNX=XANDNY=YORNX<1ORNX>20ORNY<1ORNY>21THEN2540
2600 POKEP,U:POKECO+P,UC
2620 X=NX:Y=NY:GOTO2530
2797 REM-------------
2798 REM  RANDOM
2799 REM-------------
2800 PRINT""
2810 FORY=1TO21:FORX=1TO20
```

(continued on page 183)

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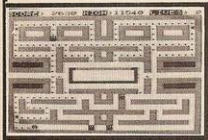

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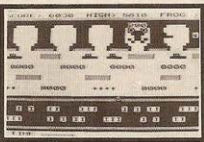

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TIMEDATA

(continued from page 181)

```
2020 IFRND(1)<X,2THENP=TC+22*V+X POKECO+P,LC POKEP,61
2030 NEXT NEXT
2040 RETURN
3000 GETA$:IFA$=""THEN3000
3010 RETURN
4997 REM ----------
4998 REM CODE LOADER
4999 REM ----------
5000 I=&28
5010 READH$:IFH$="*"THEN5050
5020 H=ASC(H$)-48 L=ASC(RIGHT$(H$,1))-48
5030 H=H*2^(H>9):L=L+7*(L>9)
5040 POKEI,16*H+L:I=I+1 GOTO5010
5050 FORJ=0TO7 READX POKE675+J,X NEXT
5060 RETURN
5100 DATA A9,17,85,01,85,FB,A9,1E,85,02,A9,96,85,FC,85,00,A9,00,8D,A1,82,8D,A2,
82,A6
5110 DATA 20,A3,03,A6,FD,E0,03,F0,08,E0,02,F0,06
5120 DATA A9,00,10,02,A9,00,91,FB,20,CC,03,AD,A2,02,C9,15,D0,E1
5130 DATA A9,17,85,01,85,FB,A9,1E,85,02,A9,96,85,FC
5140 DATA B1,FB,29,0F,C9,00,F0,04,A9,20,D0,02,A9,51,D1,01,F0,02,84,00,91,01,20,
CC,03
5150 DATA AD,A2,02,C9,2A,D0,E0,60
5160 DATA 38,A5,01,E9,17,85,FE,A5,02,E9,00,85,FF
5170 DATA A2,07,84,FD,B0,A3,02,18,65,FE,85,FE,90,02,E6,FF,B1,FE
5180 DATA C9 51,D0,02,E6,FD,CA,10,E9,60
5190 DATA AE,A1,02,E8,E0,14,D0,14,A2,03,EE,A2,02,18,A5,01,69,02,90,04,E6,02,E6,
FC
5200 DATA 85,01,85,FB,8E,A1,02,E6,01,E6,FB D0,04 E6,02,E6 FC,60,*
5300 DATA 1,1,20,2,20,1,1,0
```

Function graphs

Billy Wain,
Heckmondwike,
West Yorkshire.

BBC

THE PROGRAM occupies about 2.5K of memory. The program itself plots any graph between specified points in mode 0. By plotting the axes and choosing a suitable scale, a good graph is obtained. Points are calculated before plotting them, ensuring maximum speed when plotting. By pressing any of the function keys — 0 to 7 — example plots have been entered for the inexperienced. Scaling for the axes was done by the simple expedient of taking logs between maximum and minimum values.

```
  10 REM ... FUNCTION GRAPHS ...
  20 REM ... By B.Wain 6USc. ...
  30 REM . Example plots on red keys .
  40 *KEY 0 SIN(X) IM 0 IM 6.28 IM 0.02 IM
  50 *KEY 1 X^2 IM -10 IM 10 IM 0.1 IM
  60 *KEY 2 X^3 IM -10 IM 10 IM 0.1 IM
  70 *KEY 3 1/X IM 0 IM 10 IM 0.1 IM
  80 *KEY 4 LOG(X) IM 0.1 IM 10 IM 0.1 IM
  90 *KEY 5 1+2*COS(X)+COS(2*X) IM -6.28 IM 6.28 IM 0.04 IM
 100 *KEY 6 COS(X)^2 IM 0 IM 6.28 IM 0.02 IM
 110 *KEY 9 DEL.30,150:RUN:RUN IM
 120 MODE 7
 130 VDU 23;8202;0;0;0;
 140 PRINT TAB(9,12);CHR$(130);"Press f9 to run"
 150 VDU 21:STOP
 160 VDU 6
 170 ON ERROR GOTO 950
 180 MODE 1
 190 VDU 19,0,4;0;17,3,12
 200 PRINT
 210 PRINT TAB(12)"Function Graphs"
 220 PRINT TAB(12)STRING$(15,"-")
 230 VDU 20,2,30,37,4,17,129,12,17,3
 240 PRINT''' Enter the function of the graph."
 250 PRINT
 260 PRINT "  Write it in terms of x as shown."
 270 PRINT
 280 PRINT "     e.g.  Y=(X^2+2)^2"
 290 PRINT
 300 PRINT"  Then press 'RETURN' to continue"
 310 PRINT
 320 PRINT "  (Press f0-f6 for example plots)"
 330 PRINT
 340 INPUT TAB(5)"Y="F$
 350 IF F$="":VDU11:PRINT SPC(40):VDU11,11:GOTO 340
 360 PRINT
 370 PRINT TAB(3)"Input the range of x-values"
 380 INPUT TAB(10)"From x="V1
 390 INPUT TAB(10)"  To x="V2
 400 IF V2-V1<0 THEN VDU 28,2,30,37,16,12,28,2,30,37,4:GOTO 370
 410 INPUT TAB(10)"in steps of "step
 420 IF V2-step<V1 OR step=0 PRINT TAB(0,18);STRING$(40," ");:PRINT TAB(0,17);:G
OTO 410
 430 IF (V2-V1)/step>640 ØX=10:PRINT "With a step value of ";step;",there are"
" too many points to plot.""Input a larger step value."step=0:Ø%=&02010A:GOTO
420
 440 PRINT'''' PRESS ESCAPE TO RERUN THE PROGRAM"
 450 A$=INKEY$(100)
 460 NP=INT(V2-V1)/step)+1
 470 ØX=&02010A
 480 DIM X(NP),Y(NP),Z(9)
 490 FOR K=1 TO 9:READ Z(ØX):NEXT
 500 X=V1:Y(0)=0:Y1=0:Y2=1:M=0:N=0
 510 XX=1
 520 X(XX)=X:Y(XX)=EVAL(F$)
 530 IF Y(XX)>6000 Y(XX)=6000
 540 IF Y(XX)<-6000 Y(XX)=-6000
 550 IF Y(XX)>Y2 Y2=Y(XX) ELSE IF Y(XX)<Y1 Y1=Y(XX)
 560 XX=XX+1:X=X+step
 570 IF XX>V2 THEN SHL OSE 520
 580 XX=XX-1:SX=1024/(V2-V1)
 590 OXX=ABS(V1*SX)
 600 SY=1024/(Y2-Y1)
 610 OYX=ABS(Y1*SY)
 620 IF OYX>64 OX=0 ELSE OX=64
 630 IF OXX>986 PX=0 ELSE PX=986
 640 VDU 22,0,5
 650 VDU 29,OXX+PX;OYX+OX;
 660 MOVE 0,1024
 670 DRAW 0,-1024
 680 MOVE -1280,0:DRAW 1280,0
 690 PROCSCALE(V2,V1)
 700 REPEAT M=M+1
 710 step=Z(M)*Y
 720 UNTIL step>SX>=64 OR M=9
 730 FOR X=V1 TO V2+step STEP step
 740 MOVE X*SX,0:DRAW X*SX,-10
 750 MOVE X*SX-0,-20:PRINT;X
 760 NEXT
 770 PROCSCALE(Y1,Y2)
 780 REPEAT N=N+1
 790 ystep=Z(N)*Y
 800 UNTIL DY*ystep>=64 OR N=9
 810 FOR Y=Y1 TO Y2+ystep STEP ystep
 820 MOVE 0,Y*SY:DRAW -10,Y*SY
 830 MOVE -64,Y*SY+8:PRINT;Y
 840 NEXT
 850 MOVE 0,Y*SY:DRAW -10,Y*SY
 860 X=1:REPEAT
 870 PLOT 70,X(X)*SX,Y(X)*SY
 880 X=X+1:UNTIL X>XX
 890 GOTO 890
 900 DEF PROCSCALE(P,Q)
 910 Y=LOG(ABS(P-Q))
 920 IF Y>=.5 Y=INT(Y+0.5):ENDPROC
 930 Y=10^(INT(Y))
 940 ENDPROC
 950 REM ... ERRORS ..
 960 IF ERR=17 RUN
 970 IF ERR=18 AND XX=1 X=X+step:GOTO 510
 980 IF ERR=18 step=step+(step/1.5):X=V1-step:GOTO 510
 990 IF ERR=22 X=X+step:Y(XX)=6000:GOTO 560
1000 IF ERR=20 Y(XX)=6000:GOTO 560
1010 REPORT:PRINT " at line ";ERL:END
1020 ENDPROC
1030 DATA .1,.2,.5,1,2,5,10,20,50
```

Quick change

Mark Lowe,
Berkswell,
West Midlands.

SPECTRUM

USUALLY TO change the colour of the Paper, Ink, Bright and Flash you have to clear the screen on a 16K Spectrum. When this program is executed it changes the Paper, Ink, Bright and Flash immediately.

To use the program you have to first load the loader supplied on the sheet and run it. Once the machine code is in memory you can delete the loader and type in your program. here is an example program:

```
10 FOR N=1 TO 50: LET A=INT (RND*255):
   LET B=INT (RND*175)
20 PLOT A,B: DRAW 255-A: PLOT A,B:
   DRAW 0-A, 0-B
30 NEXT N
40 FOR N=1 TO 255:PAUSE 50: POKE 32254,N
50 RANDOMISE USR 32250: NEXT N
```

All of the code has been adapted from a list of instructions printed in Kathleen Peel's machine-code article, in August *Your Computer.* The code is only 25 bytes long so it will not take very long to enter.

```
10 CLEAR 32249
20 FOR A=0 TO 24
30 READ B: POKE 32250+A,B:NEXT A
40 DATA 33,0,88,6,0,22,3,14,255,112
50 DATA 35,13,32,251,21,32,247,14,2
60 DATA 112,35,13,32,251,201

TO USE:

POKE 32254,ATTR

POKE THE ATTRIBUTE INTO LOCATION
32254 THEN TO EXECUTE TYPE:

RANDOMIZE USR 32250

CODE      MNEMONICS

33  0  88 LD HL
6   0    <22528>
22  3    LD B<ATTR>
14  255  LD D,3
112      LD C,255
35       LD HL<B>
13       INC HL
32  251  DEC C
21       JR NZ,-5
32  247  DEC D
14  2    JR NZ,-9
112      LD C,2
35       LD HL<B>
13       INC HL
32  251  DEC D
201      JR NZ,-5
         RET TO
         BASIC
```

Writing aids

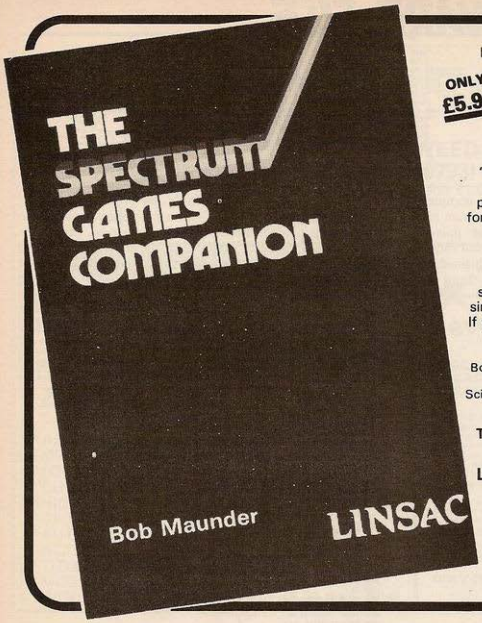
Julian Wood,
Downham Market,
Norfolk.

ZX-81

THE FOLLOWING machine-code routines are a great aid to the Basic programmer writing and developing programs. The explanation of how to enter and use each routine refers to the listings of the relevant Basic program which Pokes the machine code into memory.

First a Line Block Delete: Enter a line 1

(continued on page 187)



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Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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(continued from page 183)

Rem followed by 96 characters and then

POKE 23756,0

which changes it to line 0, so it cannot be deleted. Enter the rest of the program and Run 10, and the routine will be Poked into line 0. To delete the now unwanted data, Run the program and enter 10 and then 77 for the inputs. If all is successful you should find that lines 10 to 77 have been deleted, leaving the delete program which can be Saved as a normal program.

Next, a Utilities program. Enter it and Run it, and the machine code will be Poked in above RAMtop, and can be saved using

SAVE "util" CODE 32416,183

When loading back, it is necessary to Clear 32415 beforehand. The subroutines are as follows:

ATTR CHANGE

To use this, you simply have to use the normal Basic colour commands and then Rand Usr 32416. For example:

FOR a=32 TO 255:PRINT CHR$ a;:NEXT a:PAPER 1:INK 6:FLASH 1:RAND USR 32416

prints the character set, and then sets the whole screen flashing with blue paper and yellow ink without clearing the screen.

SEARCH AND REPLACE

Replaces any specified character with another character. Poke 32435 with the search character code and 32437 with the replace character code. For example, to change all the Print commands to LPrint:

POKE 32435,245:POKE 32437,224:
RAND USR 32434

The next Utilities subroutine is

SCREENS

This differs from the one in ROM as it works with the predefined graphics and the user defined graphics, as well as the normal ASCII characters. To use it, Print At the position on the screen you wish to check and call the routine. For example:

PRINT AT 10,10;:LET L = USR 32477

will give the code of the character at position 10,10. If there is no such character, then L will equal zero.

```
   0:REM aaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaa
   1 INPUT "From ";s;" to ";f: I
F f<s OR s<1 OR s>9999 OR f<1 OR
 f>9999 THEN GO TO 1
   2 POKE 23729,INT (s/256): POK
E 23728,s-256*PEEK 23729: RANDOM
IZE f: RANDOMIZE USR 23760
  10 LET t=95
  15 FOR a=23760 TO 23760+t
  20 READ b: POKE a,b: NEXT a
  50 DATA 237,75,176,92,205,14,9
3,229,237,75,118,92,205,14,93
  55 DATA 35,35,94,35,86,25,35
  60 DATA 209,167,237,82,229,25,
235,229,42,101,92,167,237,82
  70 DATA 68,77,225,225,237,176,
42,75,92,209,167,237,82,34,75,92
  75 DATA 42,89,92,167,237,82,34
,89,92,201
  76 DATA 42,83,92,86,35,94,235,
167,237,66,9,235,40,18,35,94,35,
86
  77 DATA 35,25,237,91,75,92,167
,237,82,25,56,229,207,10,43,201

   5 CLEAR 32415
  10 FOR a=32416 TO 32599: READ
b: POKE a,b: NEXT a
  50 REM ATTR change
  60 DATA 33,0,88,1,192,90,58,14
1,92,119,35,167,237,66,9,32,248,
201
  100 REM search+replace
  110 DATA 22,0,30,0,42,83,92,35,
35,35,35,126,14,14,185,32,3,35,2
4,243
  120 DATA 14,13,185,32,12,35,237
,75,75,92,167,237,66,9,208,24,22
6,185,32,226,115,24,223
  125 REM SCREEN$
  130 DATA 42,54,92,36,17,128,32,
205,27,127,20,30,144,33,58,127,2
13,237,91
  140 DATA 132,92,14,2,6,4,26,190
,32,12,20,16,-7,35,13,32,-13
  150 DATA 209,6,0,74,201,6,0,9,2
09,20,123,186,32,-34,42,123,92,3
0,165,205,27,127,1,0,0,201
  160 DATA 1,8,0,213,237,91,132,9
2,26,20,190,32,10,35,13,32,-9
  170 DATA 209,6,0,74,209,201,9,2
09,20,123,186,32,-30,201
  180 DATA 15,0,240,0,255,0,0,15,
15,15,240,15,255,15,0,240,15,240
,240,240,255,240,0,255,15,255,24
0,255,255,255
```

Matrix mover

K J Gouldstone,
Wallington,
Surrey.

ZX-81

THIS PROGRAM simulates some of VisiCalc's facilities on the ZX-81. The size of the matrix in this program is 19 by 4; however this could be extended.

Upper-case number keys are used to control all functions. Shift 1 will print the screen, Shift 2 will save the program and Data on tape, Shift 5, 6, 7 and 8 will move the cursor, shift 9 will let you enter a formula and shift 0 will recalculate all figures.

Each location on the matrix is given a number and a letter for example, 10A. You may enter either a number of a description in each location. Simply move the cursor to the required location and enter a value, then press Newline.

In you press Shift 9 you may enter a formula for the location. The current location should equal the value in location 04C plus the value in location 05C, enter 04C + 05C with no spaces, and press Newline. This formula is now associated with that location. Enter Shift 0 and all values will be calculated using the formulas entered.

You may enter up to eight locations in a formula and may use plus, minus, oblique and asterisk. Formulas for each location are displayed automatically when moving the cursor. The A$ array holds the values and the B$ array holds all formulas. All input to the program is by use of the Inkey$ function. The program will run automatically when loaded.

```
  1 DIM A$(19,4,7)
  2 DIM B$(19,4,31)
  9 STOP
 10 SLOW
 11 PRINT AT 0,23;"FORMULA"
 12 DIM D$(7)
 15 PRINT AT 2,0;"          A          "
 16 PRINT "B                          "
 20 FOR A=1 TO 19
 21 IF A<10 THEN PRINT AT A+2,0
;"0";A;
 22 IF A>9 THEN PRINT AT A+2,0;
A;
 25 FOR B=1 TO 4
 30 PRINT AT A+2,(B*7)-4;A$(A,B
);
 35 NEXT B
 40 NEXT A
 45 GOSUB 4000
 50 LET C=1
 60 LET R=1
 70 LET M$=INKEY$
 80 IF M$="" THEN GOTO 70
 85 LET OR=R
 86 LET OC=C
 90 IF CODE M$=112 THEN LET R=R
-1
 100 IF CODE M$=113 THEN LET R=R
+1
 110 IF CODE M$=114 THEN LET C=C
-1
 120 IF CODE M$=115 THEN LET C=C
+1
 125 IF CODE M$<112 OR CODE M$>1
16 THEN GOTO 300
 130 IF R>19 THEN LET R=1
 140 IF R<1 THEN LET R=19
 150 IF C>4 THEN LET C=1
 160 IF C<1 THEN LET C=4
 200 LET D$=CHR$ (CODE A$(R,C,1)
+128)+CHR$ (CODE A$(R,C,2)+128)+
CHR$ (CODE A$(R,C,3)+128)+CHR$ (
CODE A$(R,C,4)+128)+CHR$ (CODE A
$(R,C,5)+128)+CHR$ (CODE A$(R,C,
6)+128)+CHR$ (CODE A$(R,C,7)+128
)
 205 PRINT AT OR+2,(OC*7)-4;A$(O
R,OC)
 210 PRINT AT R+2,(C*7)-4;D$
 230 PRINT AT 1,0;B$(R,C)
 230 GOTO 70
 300 IF CODE M$=116 THEN GOTO 37
0
 301 IF CODE M$=119 THEN GOTO 10
05
 302 IF CODE M$=117 THEN GOTO 20
00
 303 IF CODE M$=218 THEN GOTO 30
00
 304 IF CODE M$=223 THEN GOTO 10
00
 305 IF CODE M$=118 THEN GOTO 70
 306 LET A$(R,C)=""
 307 PRINT AT R+2,(C*7)-4;"       "
 309 "
 310 FOR A=1 TO 7
 311 IF CODE M$=111 AND CODE M$<
116 THEN GOTO 85
 315 IF CODE M$=118 THEN GOTO 70
 316 IF CODE M$=26 THEN LET M$="
"
 320 LET A$(R,C,A)=M$
 330 PRINT AT R+2,(C*7)-5+A;CHR$
(CODE A$(R,C,A)+128)
 340 LET M$=INKEY$
 345 IF M$="" THEN GOTO 340
 350 NEXT A
 360 GOTO 70
 370 PRINT AT 0,0;"ENTER FORMULA
"
 375 PRINT AT 1,0;"
"
 377 LET B$(R,C)=""
"
 380 FOR A=1 TO 31
 385 LET M$=INKEY$
 386 IF M$="" THEN GOTO 385
 387 IF CODE M$=26 THEN LET M$="
"
 400 IF CODE M$=118 THEN GOTO 47
0
 420 LET B$(R,C,A)=M$
 430 PRINT AT 1,A-1;B$(R,C,A)
 460 NEXT A
 470 PRINT AT 0,0;"
"
```

(continued on page 189)

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(continued from page 187)

```
 450 GOTO 70
1000 FRST
1005 PRINT AT 0,0;"RECALCULATING
     "
1009 FOR A=1 TO 19
1010 PRINT AT 0,15;A
1015 FOR B=1 TO 4
1020 IF B$(A,B)="
     " THEN GOTO 1300
1021 LET S=0
1022 LET A$(A,B)=STR$ S
1030 LET U=0
1050 LET L=21
1035 GOTO 1080
1070 LET L=CODE B$(A,B,U)
1080 LET J=VAL B$(A,B,U+1 TO U+2
     )
1090 LET K=CODE B$(A,B,U+3)-37
1100 IF CODE A$(J,K)<28 OR CODE
     A$(J,K)>37 THEN GOTO 1275
1230 IF L=21 THEN LET S=VAL A$(A
     ,B)+VAL A$(J,K)
1240 IF L=22 THEN LET S=VAL A$(A
     ,B)-VAL A$(J,K)
1250 IF L=23 THEN LET S=VAL A$(A
     ,B)*VAL A$(J,K)
1260 IF L=24 THEN LET S=VAL A$(A
     ,B)/VAL A$(J,K)
1270 LET A$(A,B)=STR$ S
1275 LET U=U+4
1277 IF U=32 THEN GOTO 1280
1278 IF B$(A,B,U)<>" " THEN GOTO
     1070
1280 PRINT AT A+2,(B*7)-4;"
     "
1290 PRINT AT A+2,(B*7)-4;A$(A,B
     )
1300 NEXT B
1310 NEXT A
1315 SLOW
1320 PRINT AT 0,0;"
     "
1330 GOTO 70
2000 COPY
2010 GOTO 70
3000 CLS
3010 PRINT AT 5,0;"SET TO RECORD
     THEN PRESS N/L"
3020 INPUT U$
3030 SAVE "M"
3040 CLS
3050 GOTO 10
4000 REM MESSAGE
4010 LET K$=" PRINT,32,SAVE,32,FO
R,NEXT,32,GOTO,32,"
4020 LET X=PEEK 16396+256*PEEK 1
6397
4030 FOR N=760 TO 759+LEN K$
4040 LET Y=CODE K$(N-759)
4050 POKE N+X,Y
4060 NEXT N
4070 RETURN
```

New dimensions

B D D'Silva,
London SW19.

LYNX

THE LYNX PROVIDES some useful Basic debugging facilities such as Trace and Speed but lacks the facility, which some computers have, to dump. With it, all the variables and their values are printed and also the dimensions of array and strings.

The first of the three machine-code programs prints out the ordinary variables and their values. The second prints out the dimensions of numerical arrays and the third prints out the lengths of the strings.

All three programs are relocatable therefore they can be located in Basic in a Code line and Run using

CALL LCTN (line number)

but this is not very satisfactory since all three programs strung one after the other are too long to type in through Basic. The way round this would be to type in the lowest line number as a Rem line with the line full with any characters. Then go into MON and modify the 23 at 6953, which is the Rem token, to 33. Note these are Hex values. Number 33 is the token of Code. LCTN — lowest line number — gives 6945H, so modify address 6945 onwards with the programs.

A much better way to locate the programs is through MON and locate it high up in memory eg 9C40H which is 4E4 in decimal. EXT does a call to &6224 thus DPOKE &6225, Start address of code will give extensions to Basic.

```
PROGRAM 1 - PRINT VARIABLES

2A 0F 62 START:  LD HL,(620FH);location of
06 35            LD B,35H      ;variables
23       NXTONE: INC HL
7E               LD A,(HL)
2B               DEC HL
FE FF            CP FFH
28 1D            JR Z,NXTVAR
3E 75            LD A,75H
90               SUB B
FE 5B            CP 5BH
38 02            JR C,UPVAR
C6 06            ADD A,6
CF       UPVAR:  RST 8         ;VDU A
3E 3D            LD A,3DH
CF               RST 8
CD 2A 35         CALL 352AH   ;PRINT SPACE
C5               PUSH BC
E5               PUSH HL
CD B1 35         CALL 35B1H
CD 59 1D         CALL 1D59H
E1               POP HL
C1               POP BC
3E 09            LD A,9
CF               RST 8
11 05 00 NXTVAR: LD DE,0005
19               ADD HL,DE
10 D6            DJNZ NXTONE
3E 0D            LD A,0DH
CF               RST 8
C9               RET          ;only if other
                              ;programs are
                              ;not attached
```

```
PROGRAM 2 - PRINT ARRAY DIMENSIONS

2A 11 62  START:  LD HL,(6211H)
06 35             LD B,35H
7E        NXTONE: LD A,(HL)
23                INC HL
B6                OR (HL)
28 24             JR Z,NXTVAR
3E 75             LD A,75H
90                SUB B
FE 5B             CP 5BH
38 02             JR C,UPVAR
C6 06             ADD A,6
CF        UPVAR:  RST 8
3E 28             LD A,28H
CF                RST 8
23                INC HL
5E                LD E,(HL)
23                INC HL
56                LD D,(HL)
EB                EX DE,HL
1B                DEC DE
1B                DEC DE
C5                PUSH BC
D5                PUSH DE
CD C4 34          CALL 34C4
CD 59 1D          CALL 1D59
E1                POP HL
C1                POP BC
3E 29             LD A,29H
CF                RST 8
3E 09             LD A,9
CF                RST 8
23        NEXTVAR: INC HL
23                INC HL
23                INC HL
10 D2             DJNZ NXTONE
3E 0D             LD A,0DH
CF                RST 8
C9                RET;only if other
                     ;programs are
                     ;not attached
```

```
PROGRAM 3 - PRINT LENGTH
            OF STRINGS

2A 13 62START:  LD HL,(6213H)
06 1A           LD B,1AH
7E       NXTONE: LD A,(HL)
5F               LD E,A
23               INC HL
56               LD D,(HL)
B6               OR (HL)
28 1E            JR Z,NXTVAR
3E 5B            LD A,5BH
90               SUB B
CF               RST 8
3E 24            LD A,24H
CF               RST 8
3E 28            LD A,28H
CF               RST 8
C5               PUSH BC
E5               PUSH HL
1A               LD A,(DE)
26 00            LD H,00
6F               LD L,A
CD C4 34         CALL 34C4
CD 59 1D         CALL 1D59
E1               POP HL
C1               POP BC
3E 29            LD A,29H
CF               RST 8
3E 09            LD A,9
CF               RST 8
23       NXTVAR: INC HL
23               INC HL
23               INC HL
10 D6            DJNZ NXTONE
3E 0D            LD A,0DH
CF               RST 8
C9               RET
```

Forth surround

A R Weaver,
Swindon,
Wiltshire.

ACE

THIS PROGRAM for the unexpanded Jupiter Ace is the legendary Surround program translated into Forth with sound and high-resolution graphics. Your task is to control the man who runs around the screen trying to avoid the randomly-produced blocks which appear next to him. You must avoid having to run into a block for as long as possible and the computer keeps count of how many times you have moved. My best is 207.

A hint: try to stay in one area as long as it is safe in order to fill up as much of that part of the screen as possible.

There are three variables : a, which is your position on the screen; s, which is used to produce the random numbers; and sc which keeps count of your moves.

The words ss and rnd produce a random number. Set draws a boundary around the screen; fin is the end of the game.

Mv moves your man around the screen and check to see if you have hit a block, bk prints a block randomly next to you on the screen. Go sets up the variable and uses a Begin-Until loop to continuously keep the game going until it reaches fin. Man stores the data for the character; game starts the game.

```
0 variable a 0 variable s 0 variable sc
: ss s @ 75 u* 75 0 d + over over u<- - 1- dup s! ;
: rnd ss u* swap drop ;
: set cls 31 1 do 1 i at 160 emit 20 i at 160 emit
loop 21 1 do i 1 at 160 emit i 30 at 160 emit loop ;
: fin 20 200 do i 100 beep -10 +loop 10 1 do 1 a
@ c! 999 1 do loop 129 a @ c! 999 1 do loop loop
cls 10 10 at ." Score:" sc @ . abort;
: mv begin inkey dup 0= if drop 0 else 1 then
until 100 100 beep 32 a @ c! dup dup dup 53 = if
a @ 1- a! then 54 = if a @ 32- a ! then 55 = if a
@ 32 + a ! then 56 if a @ 1+ a ! then a @ c@
160 = if fin then sc @ 1+ sc ! 1 a @ c! ;
: bk 4 rnd dup dup dup 0 = if 160 a @ 1+ c! then
1 = if 160 a @ 1- c! then 2 = if 160 a @ 32 + c!
then 3 = if 160 a @ 32 - c! then 400 50 beep ;
: go 9550 a ! 0 sc ! set 1 a @ c! begin bk mv 2000
1 do loop 0 until ;
: gr 8 * 11263 + dup 8 + do i c! -1 + loop ;
: man 24 24 60 90 219 24 36 102 1 gr ;
: game man go ;
```

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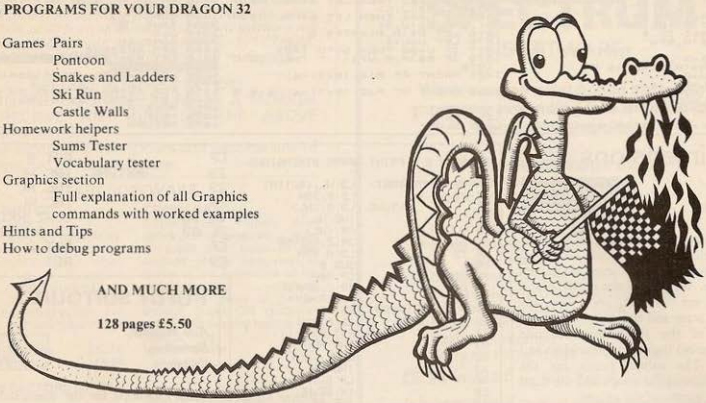

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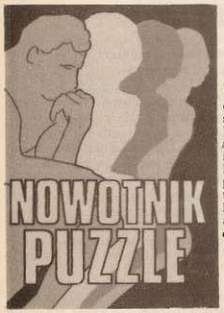

For either the 16K Spectrum or 16K ZX81, this is an original challenge for anyone. The screen becomes the playing board for this addictive puzzle. ***Machine coded*** for smooth and instant responses, it offers four levels of difficulty. The computer breaks and shuffles a two-by-two coloured square - have you the skill and mental agility to restore it? ***"Very addictive"*** - ZX Computing Feb/March 1983.

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COMPETITION CORNER

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in March. The name of the winner, the solution, and a competition report will be published in the May, 1983 issue of *Your Computer*.

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

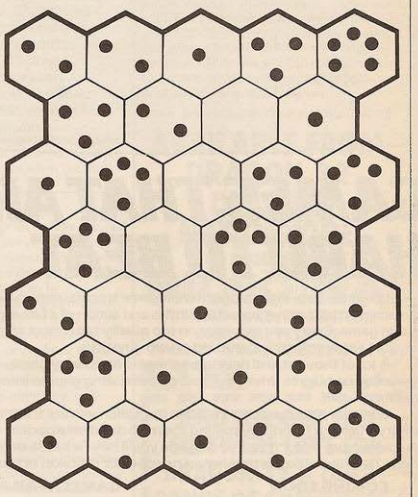
ANDROID MUTINY ON THE INTERGALACTIC HIVE-SHIP

BY ANTHONY ROBERTS

THE QUEEN of an intergalactic hive-ship has a problem: her number one android has just staggered into her control-pod bearing terrible hand-blaster damage — mutiny! She needs to know quickly the identity of its attacker, but has nothing more than the android's memory map of the numbered ID-badge of the assailant. Of course, she knows how the android was programmed to interpret this map in order to display the number. Here is the program. The first part reads the map, cell by cell and the second part interprets the map to produce a display for each cell. What is the number on the ID-badge?

The grid you see below right is the android's memory map. Below left is the program that interprets the map, and which will reveal the number on the ID badge.

```
 10 DIM m(9,9)
 15 FOR x=2 TO 8
 20 FOR y=2 TO 6
 30 READ m(x,y)
 35 NEXT y: NEXT x
 40 FOR x=2 TO 8
 45 FOR y=2 TO 6
 50 LET v=0
 55 FOR a=x-1 TO x+1
 60 FOR b=y-1 TO y
 62 LET c=0
 65 IF x=a AND y=b THEN LET b=b
+1
 66 IF x=a THEN GO TO 70
 67 IF a=2*INT (x/2) THEN LET c
=1
 68 IF a=2+2*INT (x/2) THEN LET
 c=1
 70 LET v=v+m(a,b+c)
 80 NEXT b: NEXT a
 90 LET t=0
100 LET a=INT (v/2): LET t=t+(v
-(2*a))
110 IF a>0 THEN LET v=a: GO TO
100
120 IF t=2 THEN PRINT AT x,y;"■
"
130 NEXT y: NEXT x
150 DATA 2,2,1,3,5,3,2,0,1,0,1,
4,0,3,4,4,0,4,3,0,2,0,1,2,1,4,1,
1,2,0,1,3,1,3,4
```



Competition results

BILL BENNETT'S review of the Texet TX-8000 was not overly enthusiastic which perhaps explains why the offer of a Texet as a prize in our April competition drew only a lukewarm response. Many of the entries were rather disparaging.

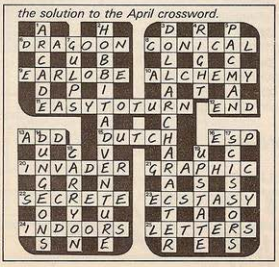
J Morgan suggested the machine should have been called "Hong Kong Phooey" while P Smith proposed "the Orid-1". "No Tex please, we're British", cried T Anderson and least flattering of all was D Duffy's "the Hong Kong Haemorrhoid — latest attack on the bottom of the market".

Some entries damned the Hong Kong micro with faint praise. A Mitton offered "The OK 4K in the U.K. from HK" and from D Lockwood came "Venus — it's a bit blurred, comes from the East and not really a star".

A Pearce was a little kinder to the Texet with "Fire Cracker — they've jumped out of the pan and taken the biscuit" and J Metcalfe's "Our kid — it is small, colourful and internally complicated" was almost affectionate.

The Texet Poppy, the Sporcitron, the Wonder Wok, the Mutant, Bill or George, the Paragon, the Comic, the Phoenix — these were some of the other names suggested for the prize.

the solution to the April crossword.



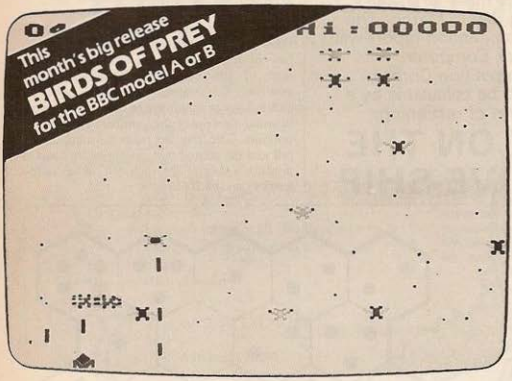
Racked with indecision we finally chose the entry from T Hardman 16 Arabin Road, London SE20, as the winner. He noticed the palindrome and suggested the stripped-down "Texet — it's a winner whichever way you look at it".

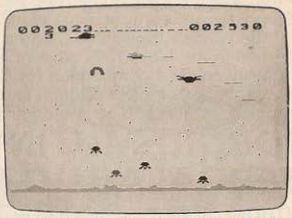
A surprising number of entries for the Pyramid of Agpar problem gave the wrong answer. Some people had not realised that there must be a central globe inside the pyramid.

The £15 book token goes to M Swain, 8 Woodland Road, Newport, Gwent, NPT 8LS, whose correct solution was the first out of the competition bag.

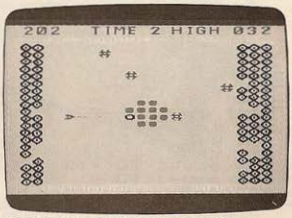
His reasoning was as follows: in 24 hours it is possible to break into 19 spheres. From each sphere you can take as many stones as there are connecting tubes. The central sphere has 12 tubes; each side sphere has nine tubes and edge spheres have six tubes.

Since you can break into 12 side spheres, six edge spheres and the one centre sphere, the total number of stones that can be removed is 156. ■

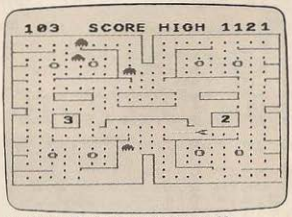




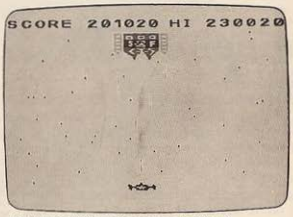
TIME DESTROYERS for the expanded Vic 20 (any RAM)



ATOM SMASHER for the unexpanded Vic 20



POWER BLASTER for the unexpanded Vic 20



SPACE FORTRESS for the unexpanded Vic 20

GAMES THAT ARE HARD TO BEAT

Why? Because every single Romik game is professionally written in machine code to give you all the thrills and action of a fast-moving arcade game. Every one recorded on top quality tape, most of them playable either from the keyboard or with joysticks.

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Romik promise at least one new game every month, and soon there'll be Romik games for the Atari, Spectrum and Lynx computers.

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Every action game purchased brings a free entry into the national competition to find the Supreme Champion, and free entry into the annual Romik Grand Master competition with its fantastic prizes.

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We're always on the lookout for new, top quality machine code arcade games for any machine. If you have what you consider a marketable game, let us know. Nobody pays higher royalties than we do.

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Space Attack
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Multisound Synthesiser

Expanded VIC 20 (3K, 8K or 16K)
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Birds of Prey

Dragon
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ZX81
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ROMIK SOFTWARE

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Address _____

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I own a _____ computer

YC 6/83

TELEWRITER™

the DRAGON 32 Word Processor

TELEWRITER

Telewriter is the powerful word processor designed specifically for the DRAGON 32 Computer. It can handle almost any serious writing job and is extremely easy to use. It has all the advanced features you need to create, edit, store, format and print any kind of text. With Telewriter you can quickly produce perfect, finished copy for letters, reports, term papers, articles, technical documentation, stories, novels, screenplays, newsletters. It is also a flexible and efficient way to take notes or organize ideas and plans.

51 × 24 DISPLAY

The DRAGON 32 is an incredibly powerful and versatile computer, but for text editing it has some major drawbacks. The small 32 character by 16 line screen format shows you too little of the text and, combined with its lack of lower case letters, bears little resemblance to the way text really looks on the page. Reverse video in place of lower case just adds confusion.

Telewriter eliminates these shortcomings with **no hardware modifications required.** By using software alone, Telewriter creates a new character set that has **real lower case letters,** and puts 24 lines of 51 characters on the screen. That's more on-screen characters than Apple II, Atari or TRS-80 Model III. That's more than double the DRAGON 32's standard display.

FULL SCREEN EDITOR

The Telewriter editor is designed for maximum ease of use. The commands are single key (or single key plus control key), fast, and easy to remember. There is no need to switch between insert modes and delete modes and cursor movement modes. You simply type. What you type is inserted into the text at the cursor, on the screen. What you see on the screen is always the current state of your text. You can move quickly through the text with one key cursor movement in all 4 directions, or press the shift key simultaneously for fast, auto-repeat. You can jump to the top or bottom of the text, and beginning or end of a line, move forward or backward a page at a time, or scroll quickly up or down. When you type past the end of the line, the wordwrap feature moves you cleanly to the next.

You can copy, move or delete any size block of text, search repeatedly for any pattern of characters, then instantly delete it or replace it with another. Telewriter gives you a tab key, tells you how much space you have left in memory, and warns you when the buffer is full.

. . . truly a state of the art word processor . . . outstanding in every respect
The RAINBOW, Jan. 1982

The only one with all these features for your DRAGON 32

51 column × 24 line screen display
Sophisticated full-screen editor
Real lower case characters
Powerful text formatter
Works with any printer
Special MX-80 driver
Requires absolutely no hardware modifications
★ Tandy colour version also available

FORMAT FEATURES

When it comes time to print out the finished manuscript, Telewriter lets you specify: left, right, top, and bottom margins, line spacing and lines per page. These parameters can be set before printing or they can be dynamically modified during printing with simple format codes in text.

Telewriter will automatically number A4 pages (if you want) and centre lines. It can chain print any number of text files from cassette without user intervention. You can tell it to start a new page anywhere in the text or pause at the bottom of the page.

You can print all or any part of the text buffer, abort the printing at any point, and there is a "Typewriter" feature which allows you to type straight to your printer. Because Telewriter lets you output numeric control codes directly (either from the menu or during printing), it works with any printer (Tandy, Seikosha, MX-80, Okidata, NEC 8023, C. Itoh 8510, Centronics, GE Terminet, Smith Corona TP-1, etc.). There's even a special driver for the Epson MX-80 that lets you simply select any of its 12 fonts and do underlining with a single underline character.

CASSETTE INPUT/OUTPUT

Because the Telewriter makes using cassette almost painless, you can still have a powerful word processor without the major additional cost of a disk. The advanced cassette handler will search in the forward direction till it finds the first valid file, so there's no need to keep retyping a load command when you are lost in your tape. The Verify command checks your cassette save to make sure they're good. You can save all or any part of the text buffer to cassette and you can append pre-existing files from those you have in the buffer already.

ASCII COMPATIBLE

Telewriter turns your DRAGON 32 into the most powerful, lowest cost, word processor in the world today. But that's not all. The simple ASCII conversion program provided with Telewriter means you can use the full power of the Telewriter editor for creating and editing BASIC and assembly language programs. It means you can use Telewriter to prepare or edit text files used with any data communications program.

Telewriter costs £49.95 on cassette and is

AVAILABLE FROM DRAGON 32 DEALERS NATIONWIDE
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24 HOUR ORDERLINE 0726 67676

SEND FOR OUR FREE SOFTWARE LISTS FOR DRAGON 32 & TANDY RANGE OF COMPUTERS.
PLEASE STATE WHICH COMPUTER YOU OWN

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Address _____

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Make / type of computer

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Please include a 1st Class Stamp

. . . one of the best programs for the Color Computer I have seen . . .
– Color Computer News, Jan. 1982

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EXCITING ADDITIONS FOR YOUR HOME COMPUTER

THE MAPLIN TALK-BACK for ZX81 and VIC20

Now your computer can talk

- ★ Allophone (extended phoneme) system gives unlimited vocabulary.
- ★ Can be used with unexpanded VIC20 or ZX81 — does not require large areas of memory.
- ★ In VIC20 version, speech output is direct to TV speaker with no additional amplification needed.
- ★ Allows speech to be easily included in programs.

Complete kits. Order As:
LK00A (VIC20 Talk-Back). Price £24.95.
LK01B (ZX81 Talk-Back). Price £19.95.
Full construction details in Maplin Projects Book 6. Price 70p. Order As XA06G.

SOUNDS GENERATOR FOR ZX81

3-Programmable tone generators with programmable attenuators turns your ZX81 into a mini-synthesiser.
Noise generator with 3 pitch levels enables the creation of most special effect sounds.
Single address access via BASIC with PEEK and POKE. Connects directly to expansion port socket or motherboard.
Complete kit. Order As LW96E. Price £10.95.
Full construction details in Maplin Projects Book 5. Order As XA05F. Price 70p.

ZX81 INPUT/OUTPUT PORT

Two bi-directional ports for a total of 16 input or 16 output lines.
Includes one buffered output which can interface directly to CMOS.
On board address selection allows for expansion to 6 ports with two boards.
Complete kit. Order As LW76H. Price £9.25.
Full construction details in Maplin Projects Book 4. Order As XA04E. Price 70p.

MODEM

A CCITT standard modem that connects directly to your telephone line via a B.T. approved transformer. Transmits and receives simultaneously on European standard frequencies at 300 baud. May be used to talk to any other 300 baud European standard modem including the Maplin Computer Shopping modem on 0702 552941 and any British Telecom Datel 200/300 Service modem. The modem's computer interface is RS232 compatible.
A complete kit excluding case is available. Order As LW99H. Price £39.95.
Full construction details in Maplin Projects Book 5. Order As XA05F. Price 70p.

KEYBOARD with ELECTRONICS for ZX81

- ★ Full size, full travel keyboard that's simple to add to your ZX81 (no soldering in ZX81).
- ★ Complete with electronics to make "Shift Lock", "Function" and "Graphics 2" single key selections.
- ★ Powered (with adaptor supplied) from ZX81's own standard power supply.

Full details in Project Book 3 (XA03D). Price 70p
Complete kit (excl. case) £21.90.
Order As LW72P.
Case £4.95. Order As XG17T.
Ready built-in case £29.95.
Order As XG22Y.

ZX81 TV SOUND

ZX81 sound on your TV set.
Video reversing switch for normal or inverse video display. Can be used with the Talk-Back or Sounds Generator kits.
Complete kit. Order As LK02C. Price £19.95.
Full construction details in Maplin Projects Book 6. Order As XA06G. Price 70p.

ZX81 EXTENSION BOARD

Our ZX81 Extendiboard plugs directly into the ZX81 expansion port and will accept a 16K RAM pack and three other plug-in modules simultaneously. Parts are sold separately as follows:
PCB Order As GB08J. Price £2.32.
Edge Connectors (4 needed) Order As RK35Q. Price £2.39 each.
Track pins (1 pack needed). Order As FL82D. Price 85p per pack of 50.

INTERFACES for MODEM

Interfaces for most popular home computers which do not have RS232 ports will be available shortly. An interface for the ZX81 that includes a complete Machine Code Communications Program is available. Order As LK08J (ZX81 Modem Interface Kit). Price £24.95.
Full construction details in Maplin Projects Book 7. Order As XA07H. Price 70p.

MAPLIN

Maplin Electronic Supplies Ltd., Mail Order: P.O. Box 3, Rayleigh, Essex SS6 8LR.
Tel. Southend (0702) 552911 (Sales).

159-161 King St., Hammersmith, W6. Tel. 01-748 0926. 284, London Road, Westcliff-on-Sea, Essex. Tel. (0702) 554000. Lynton Square, Perry Barr, Birmingham. Tel. (021) 356 7292.
All prices include VAT & carriage. Please add a 50p handling charge to orders under £5 total value.

PROGRAMPOWERMICROPOWER

MOONRAIDER

A GREAT NEW BBC MODEL B PROGRAM FROM BRITAIN'S LEADING SOFTWARE HOUSE!

You're flying a highly manoueverable 32K Space Fighter armed to the teeth with a rapid-fire laser cannon and the latest Tryex bombs. Your mission is to penetrate the alien moon defences. Against you are self-firing rockets, nuclear Ack-Ack guns, spacemines, 'fizzers', and meteors, not to mention the network of narrow passageways which must be negotiated. You have only limited fuel which needs to be replenished by either bombing the enemy fuel dumps or docking with the refuelling station. There are 6 phases to get through and 4 levels of difficulty. The game can be started at any phase and on any level. The controls are either from joysticks or from standard or user-defined keys. This exciting program only £6.95!

Other B.B.C. programs available: Swoop (B) £6.95/Croaker (B) £6.95/Chess (B) £6.95/ Laser Command (B) £6.95/Galactic Commander (B) £6.95/Alien Destroyers (B) £6.95/Adventure £6.95/Cowboy Shoot-Out (B) £5.95/Filer £8.95/Micro Budget £6.95/ World Geography (B) £5.95 Timetrek (B) £6.95/ Spacemaze (B) £5.95/Martians (B) £5.95/ Astro Navigator (B) £4.95/Star Trek £4.95/ Munchyman £5.95/Seek £5.95/Eldorado Gold (B) £5.95/Cat and Mouse £4.95/Mastermind £3.95/Reversi 1 £4.95/Reversi 2 (B) £4.95/ Roulette (B) £4.95/Gomoku £3.95/Zombies £3.95/ Dissassembler £5.95/Constellation (B) £5.95/ Junior Maths Pack (B) £5.95/Where? (B) £5.95.

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Fantastic reductions & offers on the TEXAS TI-99/4A see our ad. on next double page for details.

PRESTEL

See PRESTEL Page 600181 for up to date information from SPECTRUM

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Next to many of our offers, you'll find a few lines tagged **SPECTRUM FACTS**. We pride ourselves on providing you, the customer, with a **genuine service** as well as **super LOW prices**, and we want you to know that when you buy from a **SPECTRUM** dealer, you'll get **exactly the right micro for your needs. SO LOOK OUT FOR YOUR SPECTRUM FACTS!**

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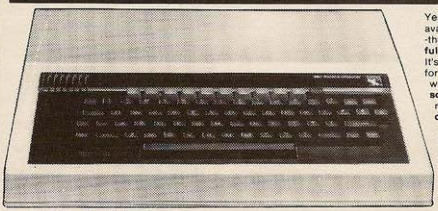
COMPUTER DEALERS

The **SPECTRUM** dealer list is virtually closed. If your area is free and you'd like to join the waiting list, please write to **MIKE STERN, Spectrum (U.K.) Ltd, Burrowfields, Welwyn Garden City, Herts.**

BBC Model 'B' MICRO



Yes, this **top selling Micro system** is now available from your local **SPECTRUM** dealer -the **BBC Model 'B'** offering **32K RAM** plus a **full back-up** of **peripherals & software** too! It's an **infinitely expandable** machine, ideal for the **home or business** and is already widely used for **educational purposes in schools** -so the chances are **your** children may already be **well familiar with its operation,** which must make it the **ideal choice** for the **home** too! So if you're thinking of buying a micro you **must** take a look at the **BBC** at your local **SPECTRUM** dealer **NOW!** - but just one word of warning, initially stocks will be limited and **demand is bound to be great,** so please 'phone to check the stock position before making a journey.

BBC 'B' with Disk Interface
£470.50
BBC Disk Interface Kit
£95.00
BBC Single Disk Drive 100K
£265.00
BBC Dual Disk Drive 800K
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BBC Tape Recorder
£29.90
BBC Acorn Software Cassette based from
£9.95
BBC Disk based software
£11.50

Spectrum Price

£399.00 INC. VAT

Please Note!

We regret that there is a tremendous shortage on all BBC equipment — please phone your nearest store before making a journey to check stock position.

SHARP MZ-80A

FREE! £75 WORTH of software with every MZ80A purchased

Desk top genius! the all-in-one SHARP MZ-80A. Ready to run the moment you get it home. Built-in keyboard. CRT. 9" display and cassette data storage with **48K RAM.** The BASIC with extra useful additions, offers quite a powerful micro for the home or business. ■ 4K Byte ROM 48K Byte RAM · 2K Byte Video RAM ■ ASCII profiled keyboard · numeric pad ■ 2page Video RAM allows screen to be scrolled up or down. ■ CP/M available.

Spectrum Price £546.25 Inc. VAT

Floppy Disks and Accessories for MZ80A

Twin Floppy Disk unit (inc. I/O Card, Disk, Cable)	£856.75
Twin Disk Unit (only)	£678.50
Single Floppy Disk Unit	£460.00
Cable for F/D Drive	£29.79

Printers and Accessories for MZ80A, MZ80B & MZ80K

80 Col Tractor Feed Printer inc. Cable, I/O Card & Rom	£477.25

ORIC-1

A superbly designed and engineered micro and great value-for-money from **SPECTRUM.** Offering **48K RAM Colour** - (8 foreground and 8 background can be displayed at same time) **High resolution graphics User definable Graphics. Full sound** (6 octaves of controllable sound) **Easy to use keyboard with moving keys. Standard Centronics parallel interface allows** easy connection to a wide range of printers etc

Spectrum Price £169.95 Inc. VAT

SPECTRUM FACTS

Maximum user RAM	47,870 Bytes
Text screen	28x40
High Resolution	240x200
Cassette Lead	Included

Not all stores carry every advertised item, please phone before making a journey — Prices correct at time of going to press E. & O.E.

The powerful and infinitely expandable

LYNX

Just look at this **super new LYNX Micro - an incredible** 16K & 32K video ram and that's expandable up to or beyond 96K. For just **£225.00 INCLUDING VAT** the **LYNX is exceptionally versatile.** All **LYNX's** 'add-on' connections are **standard types.** The high definition **colour graphics** make it a **top value choice** for the **home or office** (with expansion, the **LYNX** can become an 80 characters-per-line word processor!) Take a look at the **LYNX** - a memorable bargain from **SPECTRUM.** But please phone to check stock position before making a journey as this machine is bound to be in **great demand.**

Spectrum Price

£225.00 Inc. VAT

VISCOUNT - Teach yourself LYNX BASIC **£6.95**

SPECTRUM FACTS

Maximum user RAM	13,700 Bytes (approx)
Text Screen	24x30
High Resolution	265x248
Cassette Lead	Included

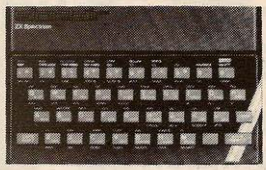
COLOUR GENIE

A truly reliable micro and highly recommended by **SPECTRUM** featuring powerful and sophisticated COLOUR GRAPHICS, allowing you to create full 8-colour Games, Diagrams and charts quickly and simply. Powerful 16KK RAM memory (expandable internally to 32K) for FULL COLOUR video games and POWERFUL COMPUTING with a full range of inexpensive accessories: 16K RAM pack, Joysticks for TV games, Light Pen, Disk Drive and a Printer. The superb Colour Genie is at SPECTRUM now - check it out and see the Genius at work!

Spectrum Price £224.48 Inc. VAT

COLOUR GENIE ACCESSORIES	
Joysticks	£49.49
16K RAM	£38.50
Printer Interface	£39.95
VISCOUNT Teach yourself Colour Genie Basic	£6.95
SPECTRUM FACTS	
Maximum user RAM	**14,200 Bytes (approx)**
Text screen	**24x40**
High Resolution	**160x90**
Cassette Lead	**Included**

SINCLAIR ZX SPECTRUM



Yes, this top selling micro is now available from Spectrum in both **16K** and **48K RAM**. So now there's no need to send by Mail Order - just call into your local SPECTRUM dealer and pick one up. But just one word of warning: with this added availability advantage, stocks are bound to sell fast - so make it soon!

SINCLAIR ZX SPECTRUM 16K - £99.95
SINCLAIR ZX SPECTRUM 48K - £129.95

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

SINCLAIR ZX-81

SINCLAIR ZX . . . £49.95
16K RAM pack . . . £29.95
ZX Printer £39.95

Computer Bookshop Software for Sinclair Computers	INC. VAT
Bumper 7 1K ZX81	£5.95
1K Super Trio ZX81	£7.95
Labyrinth 16K ZX81	£6.95
Nightmare Park/Music 16K ZX81	£6.95
Computacalc 16K ZX81	£7.95
Personal Banking System 16K ZX81	£11.44
Space Invaders/Rescue 16K ZX81	£6.95
Breakout 16K ZX81	£5.95
Mugsy 16K ZX81	£6.95
Mergatroyds 16K ZX81	£5.95
Progmerge 16K ZX81	£5.95
Football Manager 16K ZX81	£7.95
Cassettes for ZX81 Type—10	
6 Games	£3.95
Junior Education	£3.95
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Skill & Judgement Games	£3.95
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Type—40	
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ZX-PANDA
16K RAM PACK
ONLY £24.95

OKI MICROLINE Printers

Now from **SPECTRUM** - this **top selling** range of printers **renowned throughout the world for their quality and reliability.** If you're thinking of adding a printer to your micro then you must take a look at the **MICROLINE** range at **SPECTRUM -NOW!** they're **fantastic value-for-money**

Models available

MICROLINE Model 80 £259.90
MICROLINE Model 82A £455.40
MICROLINE Model 92P £585.35

EPSON

The new EPSON RX-80 and FX printers now available—check with your local SPECTRUM dealer NOW!

FX-80 Spectrum Price £503.70
RX-80 Spectrum Price £332.35

SEIKOSHA

GP-100A

Now a top quality graphic printer at a price you can afford. Centronics interface connects easily with most micros.
Spectrum price **£229.94** inc VAT Cables & Interfaces available for most micros

SMITH CORONA

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Microprocessor controlled, high quality daisy wheel printer at a LOW cost from SPECTRUM. Serial, Parallel or IEEE Interface.
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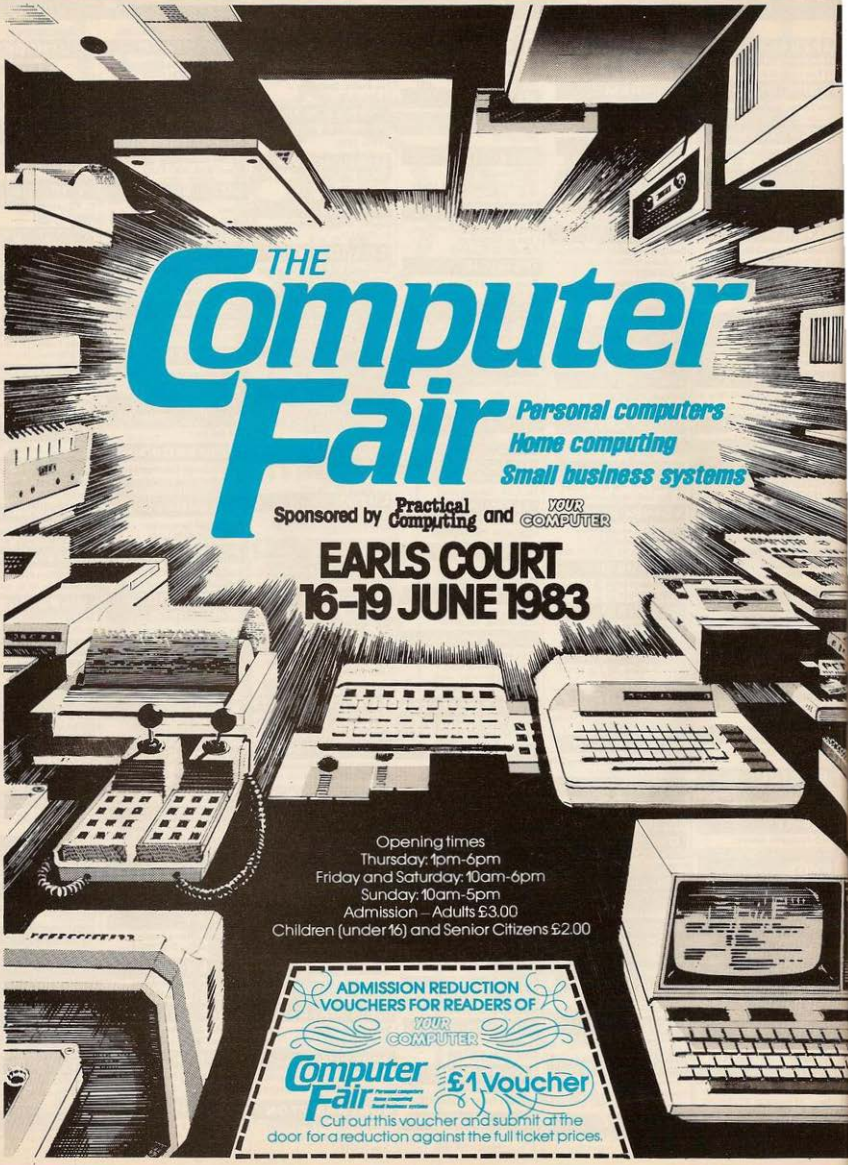
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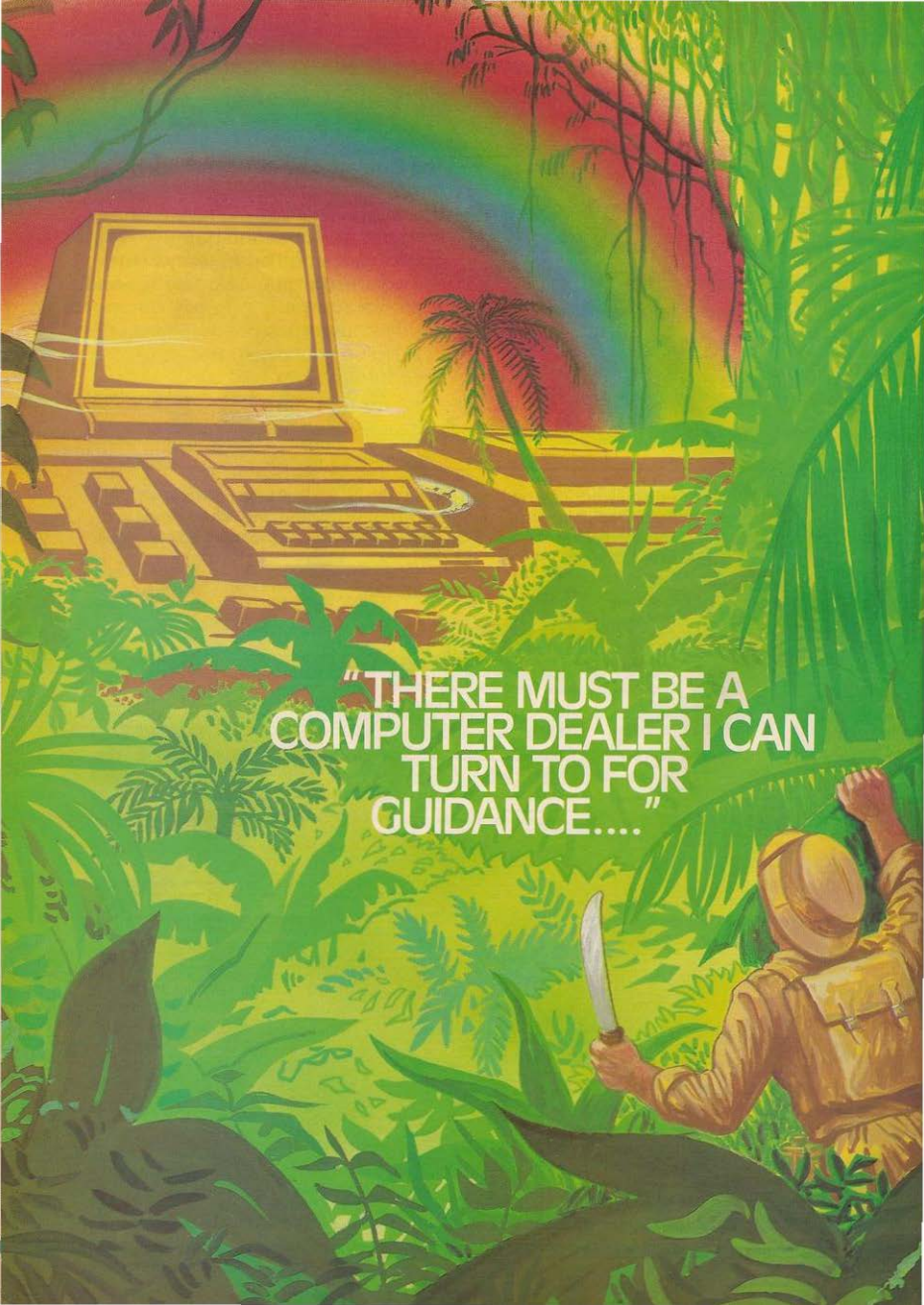
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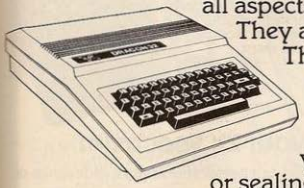

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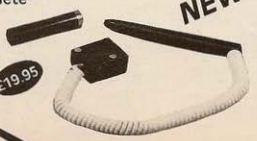

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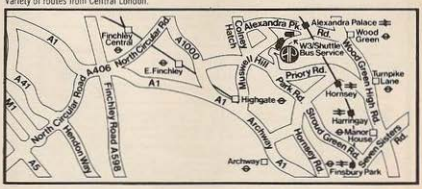

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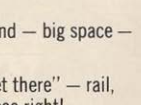

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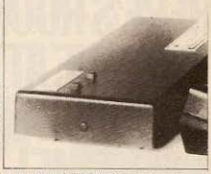

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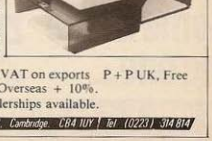

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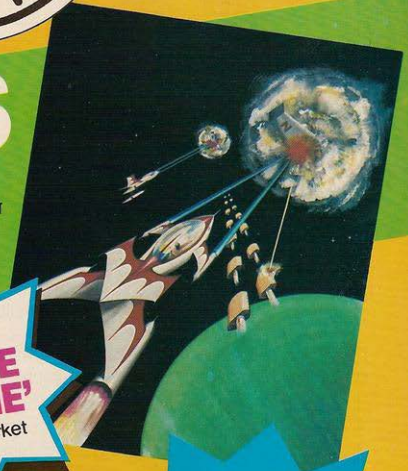

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Although the NewBrain is conceived as a total system, the unexpanded Processor itself has a great deal to offer. It is available in two forms: Model AD, shown below, with a built-in line display; and Model A, without the line display. Both models can operate with a monitor or a television set.

MEMORY

- 24K bytes of ROM;
- 32 bytes of RAM, at least 28K of which is available to the user.

THE SCREEN DISPLAY

- 40 or 80 characters to the line – without affecting the 28K bytes of RAM at your disposal;
- 24 or 30 lines to the screen;
- well-formed characters, with true descenders;
- a full European character set;
- normal or reverse video, high resolution graphics on screen of controllable size, 256, 320, 512 or 640 horizontal resolution by 250 vertical lines;
- a facility to set up a "page" of up to 255 lines, with the screen acting as a "window" to display it;
- ability to maintain several such pages simultaneously, and to switch rapidly between them;
- text may be used on graphics screen as well as on parts of the video screen not used by graphics.

CHARACTER SET

- 512 characters, including the full ASCII set, all European accented characters, Greek and graphics symbols.

GRAPHICS

- 20 powerful graphics commands;
- all text characters usable on the graphics screen;
- variable-sized graphics screen, with the rest of the screen available for text – for versatility and to save memory.

SOFTWARE

Enhanced ANSI BASIC; screen editor (32 commands); mathematics package (10 significant figures); graphics commands.

- a very friendly screen editor – a delight to use and readily adapted to text processing;
- arithmetic to 10 significant figures;
- very controllable output formatting of numbers – invaluable for accounting, statistics, and scientific applications;
- a powerful, much enhanced BASIC;
- a very flexible operating system, which allows any data stream to be opened to any device.

INTERFACES

- two tape cassette ports built into the processor unit;
- a built-in printer interface;
- a built-in communications interface (V24/RS232);
- a video monitor interface;
- a TV interface;
- an expansion interface for NewBrain system expansion modules.

KEYBOARD

- standard typewriter pitch, action, layout and size, with editing control and graphics keys.

*CP/M IS A REGISTERED TRADE MARK OF DIGITAL RESEARCH INC.

You can get everything in the box on the

If you understand the facts and figures on the left you'll soon realise that NewBrain has to be one of the most powerful micros around.

However, if you find the box on the left a little hard to follow, don't worry.

We've got over 120 dealers nationwide who've got all the answers at their fingertips.

Either way you'll discover that NewBrain is the kind of micro that will stop the competition getting a look in.

At £269 it starts off with twice as much memory as most of its competitors and can expand to over thirty times that amount. So there's no chance of being left behind in the micro race.

It comes with a very powerful language (enhanced ANSI BASIC) and it'll take CP/M, so it'll work on the same system as similar big business micros, giving you the capacity to use an almost limitless variety of tried and tested software.

But most of all NewBrain is a machine that can expand.

It's designed to take disks, printers and memory expansion modules (up to 2M bytes) plus anything else you'd expect a professional business micro to handle.

So, whether you understand the box on the left or not, pay a visit to someone in the know on the right.

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Critical review?

"The sound commands on the Oric I are, for a computer of this price, very sophisticated. Three music channels, and one noise channel, mean that you can program some fairly complex sounds."

POPULAR COMPUTING WEEKLY

"Oric is everything you hoped it would be. Alive with colour, and zapping with built-in sound effects, the Oric looks like a match for any machine now selling for less than £200"

YOUR COMPUTER

"The 16k Oric – fighting the 16k Spectrum – is £25 cheaper. It feels a good deal more 'professional' than the home-appeal Sinclair. Oric's sound is extremely versatile, and well up to the standard of the £300 or £400 BBC microcomputer made by Acorn."

WHICH MICRO?

"Oric was over twice as fast as the Spectrum. Surprisingly perhaps the Oric, which initially seemed only faster when performing the simplest of calculations, has come back to beat the Spectrum by a small amount. As the problems get more complex the Oric comes into its own. One final point – in entering the benchmark tests – the Oric was certainly the easiest to handle."

WHICH MICRO?

"This slope coupled with the design of the keys makes the Oric an easy machine to touch-type on. All keys have auto-repeat and there are four keys dedicated specifically to cursor control. It is certainly easier to type on than any of Sinclair's offerings."

YOUR COMPUTER

"Oric will soon be selling a Modem so that Prestel will become available. Owners will be able to accept telesoftware – programs loaded straight down the phone line – eventually electronic mail could come into the home by the same route, and with the addition of a tape recorder the Oric with its Modem could become a telephone answerer and message taker."

YOUR COMPUTER

"One good feature of the Oric is an on-screen reminder in the top right hand corner to show that you've engaged all-capitals mode. So much better than the BB's variety of lights in the corner of the keyboard. The Oric is sound, simple to get along with and offers great expansion potential."

WHICH MICRO?

"When compared to the stogginess of the Spectrum's keyboard this is certainly an improvement. I can't see any Orics failing through bad assembly. If only the £2400 IBM were so easy to use."

WHICH MICRO?

"Instead of the Spectrum's 28 look-up single-character error reports, the Oric has 18 self-explanatory messages. If you actually want to do computing, rather than just exploring the world of off-the-shelf games programme entertainment the Oric will be a better buy."

WHICH MICRO?

"A good speaker and built-in noises get the Oric's sound off to a good start. Typing Zap, Ping, Shoot or Explode produces convincing arcade game noises which can easily be incorporated into any program."

YOUR COMPUTER

"The modem is certainly unusual in a machine of this price. Together with the other peripherals, when finally available, it should make for an attractive package for a small business ... surely a match for machines costing much more"

POPULAR COMPUTING WEEKLY

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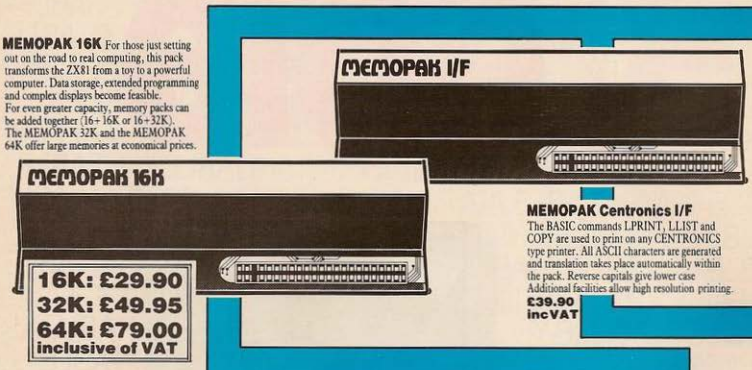
MEMOPAK 16K For those just setting out on the road to real computing, this pack transforms the ZX81 from a toy to a powerful computer. Data storage, extended programming and complex displays become feasible.
For even greater capacity, memory packs can be added together (16+16K or 16+32K). The MEMOPAK 32K and the MEMOPAK 64K offer large memories at economical prices.



16K: £29.90
32K: £49.95
64K: £79.00
inclusive of VAT

MEMOPAK Centronics I/F
The BASIC commands LPRINT, LLIST and COPY are used to print on any CENTRONICS type printer. All ASCII characters are generated and translation takes place automatically within the pack. Reverse capitals give lower case. Additional facilities allow high resolution printing.
£39.90 incVAT

It all adds up to an efficient, modular computer system

The **Memotech** approach to microcomputing is to take the well-proven and popular ZX81 as the heart of a modular system. This small computer houses the powerful Z80A processing unit and acts as the central processor module through which the **Memopaks** operate.

Memotech has a reputation for professional quality, producing units which are designed to fit perfectly, to look well-balanced, and to work efficiently and reliably.

The modular approach gives ZX81 owners the freedom to design the system they really need. Furthermore, the intercompatibility of the modules ensures that later additions will click straight in, to give you a system that grows with your ambitions and abilities.

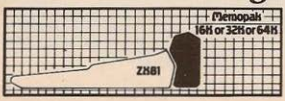
To ensure that your expectations are realised, care is taken at every stage to design features into the system to anticipate your needs. For example:
1) Memories are cumulative e.g. 16K and 32K can be added to the **Memopak 16K** or even to the Sinclair 16K RAM pac
2) The **HRG** firmware allows commonly used constructions (such as scrolling, shading and labelling graphs), to be calle by a few simple commands. 3) The **Centronics I/F** converts ZX81 character codes into ASCII and extends the print line the width of the printer, still using the LLIST, LPRINT an COPY commands.

As one example, a system with 16K of memory and **Memocalc** is all that is required to perform the same sophisticated numerical projections as a computer at 10 time the price. The problem may be as complicated as a cash flo or production schedule, or as simple as household accounts pocket money budgeting. If your bank manager wants to se cash flow, then a single print instruction to the **Centronics** will give a printout which is more than acceptable.

The example system which is shown, on the other hand would satisfy the needs of someone who wanted to enter dat

How it all fits together

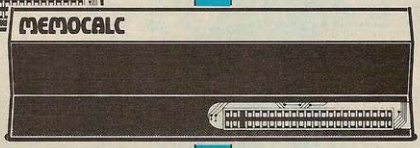
You can see from the diagrams how various Memotech/Sinclair units can be combined.



otech,
tial of your ZX81...

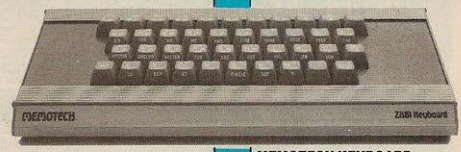
MEMOCALC The screen display behaves as a 'window' on a large sheet of paper on which a table of numbers is laid out. The maximum size of the table is determined by the memory capacity, and with a MEMOPAK 64K a table of up to 7000 numbers with up to 250 rows or 99 columns can be specified. Each location in the table can be either a number which is keyed in or a formula which generates a number.

£29.90 inc VAT



MEMOPAK HRG This pack breaks down the constraints imposed by operating at the ZX81 character level and allows high definition displays to be generated. All 248 × 192 individual pixels can be controlled using simple commands, and the built in software enables the user to work interactively at the dot, line, character, block and page levels. Scrolling, flashing and animation are all here.

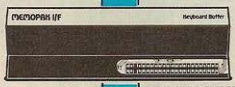
£39.90 incVAT



MEMOTECH KEYBOARD

The Memotech plug-in Keyboard plus buffer pack takes the effort out of data entry for ZX81 users. The Keyboard has a light professional touch and is housed in an elegant aluminium case. The simple plug-in system means that you are not obliged to open up your ZX81, use a soldering iron or invalidate your ZX81 warranty.

£49.95 inc VAT



KEYBOARD BUFFER PAK
The Buffer Pak performs a "housekeeping" function for the Keyboard, interfacing directly with the port at the back of your ZX81.

via a light-touch keyboard, construct and label graphs, and then copy the screen to an 80-column printer. Only 16K of memory is shown here but with additional memory, more than one video page can be stored. Up to 7 pages can be displayed in rapid succession to give animated displays.

Looking forward, **Memotech** will continue to back the ZX81 through 1983 with fast storage devices, pressure sensitive electronic drawing boards and more software packs including a **Wordprocessor,** an **RS232 Interface** and a **Z80 Assembler.**

MEMOTECH products are available from major branches of W.H. SMITH'S & JOHN MENZIES

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5 ferocious, medieval Japanese **Warlords** and pirate bands who have been successfully invading **Dragon** and **ZX 81** homes, are now poised to attack the homes of **Spectrum** and **Tandy** owners. Will you be able to resist this challenge? To succeed you must marshall your forces of warriors and Samurai, build and maintain your merchant ships, safeguarding them from attack and plan your village's food supply. To survive you must defeat all your opponents by attacking them, resisting their attacks and making raids. See the results of your decisions on graphics map of Japan for pirate battles and other graphics for Samurai, army and personal combat. The price of failure is high. Order as **WARLORD.**

Availability DRAGON 32: SPECTRUM 48K: TANDY 32K COLOR COMPUTER: ZX 81 16K (Note ZX 81 omits some of the above features and does not include graphics)

ROMAN EMPIRE

Yes **Atari**, **Tandy** and **Dragon** owners can now discover the challenge offered by our largest selling **Spectrum** game in which you are Emperor of Rome and must attempt to manoeuvre your legions and armies to subdue the provinces of the Empire. A test of your generalship with **3 Levels of play** and variable starting strengths for your opponents.

Atari, **Dragon** and **Tandy** versions feature **colour graphic maps** and supporting graphics for battle results. **Spectrum** version uses User Defined Graphics.

Availability ATARI 800 and ATARI 400 (48K extended): TANDY 32K COLOR COMPUTER: DRAGON 32: SPECTRUM 16K: ZX 81 16K

Not a wargame but a 3 phase real time game which gives you command on a Royal Navy ship at the time of Nelson. Your mission is to intercept **French Privateers** who are operating in the Baltic and the 1st phase requires you to lay the elevation and fuse for your mortar to **knock out a shore battery.** Phase 2 allows you to sail your ship (using arrow keys) to **intercept** the **Privateers.** If you succeed then you pass to phase 3 where the keys 1-9 will **fire your guns.** Be careful he doesn't escape at this late point or, worse still sink you.
5 Privateers to be intercepted each game, your continued service and promotion in the Navy are dependent on your success.
DUAL PURPOSE CASSETTE ONLY £4.50 contains Spectrum 48K and ZX 81 16K versions on same cassette.

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Spectrum version uses character defined graphics, **Dragon** features high resolution graphics including a **map for naval battles** and blocked disposition of troop for land battles.

Availability DRAGON 32: SPECTRUM 16K ZX 81 16K

ALSO AVAILABLE **SAMURAI WARRIOR (DRAGON 32: SPECTRUM 16K: ZX 81 16K)**
PELOPONNESIAN WAR (ZX 81 16K)

All games contain comprehensive playing instructions and they play differently at each level (where applicable) and on each occasion. All ZX81 need 16K Ram.
PRICES: SPECTRUM **£5.50**: ZX81 **£4.50**: DRAGON **£6.95**
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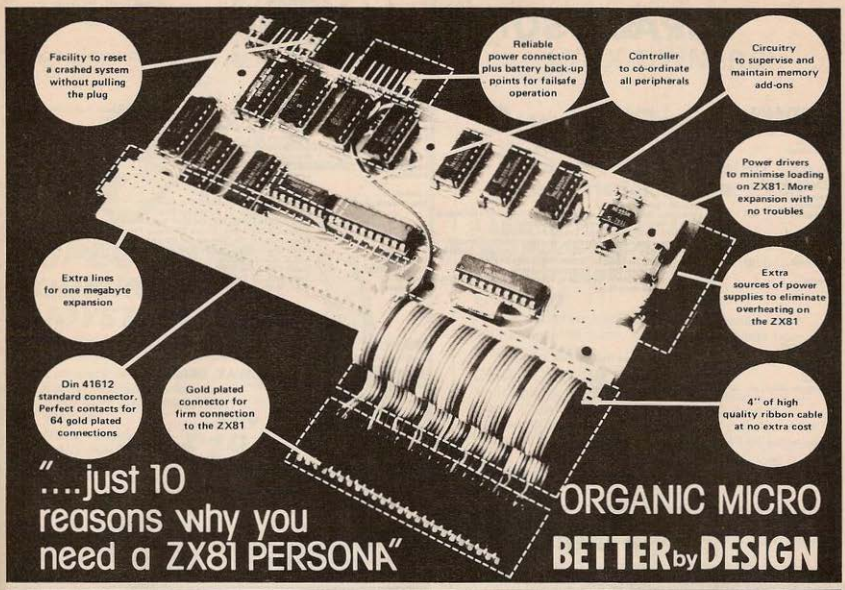

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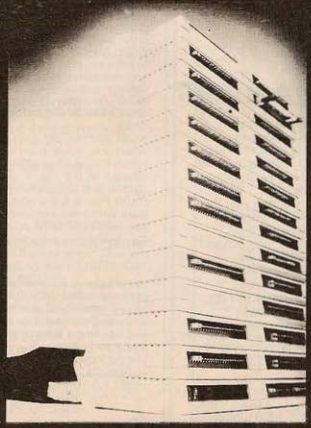

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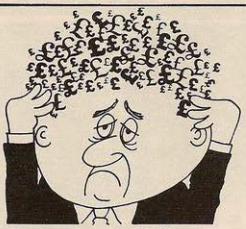

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Hisoft Pascal 4 is a professional piece of software designed by a team who have been writing Pascal compilers for many years — you will find it to be powerful, flexible and very easy to use.
To top it all, we are offering the package (which includes a 60 page manual), for a limited time, to 48K ZX SPECTRUM users at an INCREDIBLE price of only £25 inclusive.

We also have a powerful assembler, disassembler and de-bugger package called DEV PAC. This includes a fast assembler that allows conditional assembly and has many assembler commands, a labelling disassembler and a de-bugger which is very easy to use and has single step facility.
STOP PRESS: See the review in May issue of *Your Computer*.
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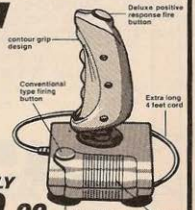

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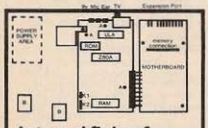

Internal fixing for ZX 81 keyboard case.

Internal fixing for spectrum keyboard case.

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ZX 80~81 Spectrum HARDWARE

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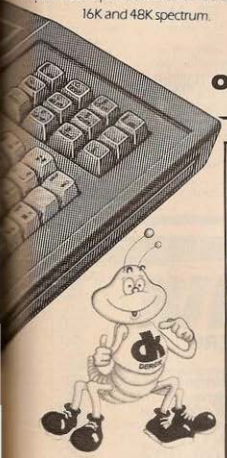

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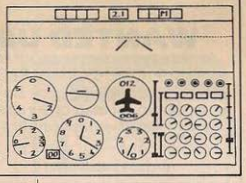

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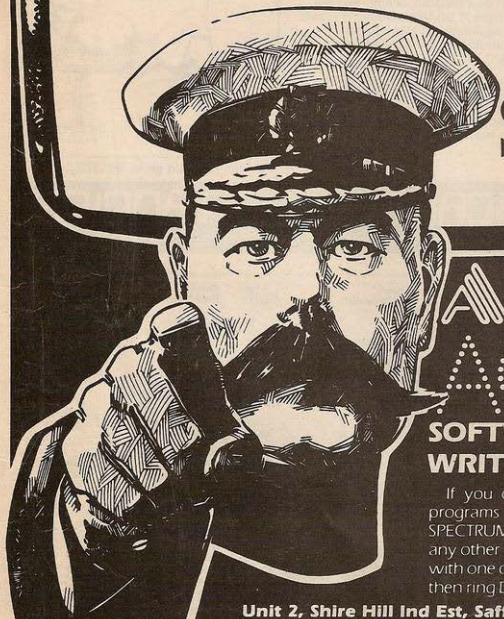

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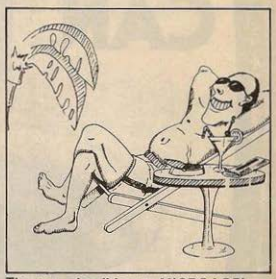

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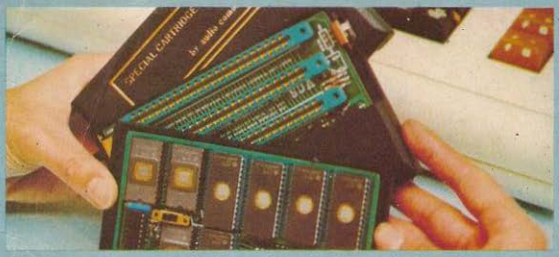

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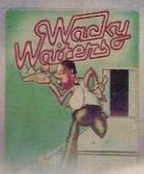

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